THE PRINCIPLES

AND

PRACTICE OF PHOTOGRAPHY

FAMILIARLY EXPLAINED;

BEING A

Manual for Beginners,

AND REFERENCE BOOK FOR EXPERT PHOTOGRAPHERS.

COMPRISING

THE COLLODION PROCESS;

PRINTING AND TONING.
THE BEST DRY-PLATE PROCESSES.
THE MANAGEMENT OF LIGHT.
HOW TO MAKE A GOOD GLASS ROOM.
TRANSPARENCIES FOR DOCORATING WINDOWS AND FOR THE MAGIC LANTERN.
CABINET PICTURES.
OPALOTYPES.
ORGANIC IRON DEVELOPMENT.
COPYING AND ENLARGING.
MULTIPLYING NEGATIVES.
THE SOLAR CAMERA.
LIFE-SIZE PORTRAITS.

DEFECTS, FAILURES, AND REMEDIES,

&c., &c., &c.

BY JABEZ HUGHES,

PHOTOGRAPHER TO THE QUEEN, H.R.H. THE PRINCE OF WALES, AND THE ROYAL FAMILY.

Seventh Edition, carefully Revised.

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JABEZ HUGHES, 379, OXFORD STREET, W.

PREFACE TO THE SEVENTH EDITION.

In this manual the Author has endeavoured to give simple and clear directions for producing photographs. He has adopted the familiar style as admitting of the plainest and most homely language. The pupil has always been supposed to be at his elbow. The object has been to remove as many difficulties as possible from the path, and to render the commencement interesting. There has been no desire, however, to hide from the pupil the real difficulties that he may encounter in practice; he is rather prepared for them, and instructed how to meet some and avoid others.

Part I. is therefore confined to elementary manipulations and simple directions; many instructions and suggestions are more fully explained at a later part of the book, when it may be supposed that, with more extended experience, he may be better able to appreciate them.

Part II. is confined to dry-plate photography. This is a subject quite distinct, and is fitted more for the use

of amateurs than professionals. The general principle of all the dry processes is distinctly stated, and the most useful of them are fully described.

Part III. is devoted to subjects that imply a full knowledge of practical details. In this part the writer has compressed much of the matter that he has contributed to photographic literature in the form of papers to various photographic societies, and to the journals devoted to the art. His constant object, whether addressing the tyro or the experienced photographer, is to beget a love for the art and a desire for its improvement. The progress that has been made by photography is mainly due to the interchange of knowledge among those who practice the art, and, imbued with the same feeling, the larger the circle becomes, the greater will be the security that this fascinating art will arrive at still higher degrees of advancement.

Ryde, November, 1866.

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ENGLISH WEIGHTS AND MEASURES.

Troy or Apothecaries' Weight.				Avoirdupois Weight.			
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60	„	=	1 drachm	27$\frac{1}{3}$	grains	=	1 drachm
480	„	=	1 ounce	437$\frac{1}{2}$	„	=	1 ounce
12	ounces	=	1 pound	16	ounces	=	1 pound

FLUID MEASURE.

60 minims = 1 drachm
480 „ = 8 „ = 1 ounce
160 drachms = 20 ounces = 1 pint
8 pints = 4 quarts = 1 gallon

FRENCH WEIGHTS AND MEASURES.

1 gramme *weighs* nearly 15$\frac{1}{2}$ English grains (15·433)

1 „ = 10 decigrammes = 100 centigrammes = 1000 miligrammes

1 kilogramme = 1000 grammes = nearly 2$\frac{1}{4}$ lbs. avoirdupois (2·247)

1 litre is equal to nearly 35$\frac{1}{4}$ fluid ounces (35·2)

1 cubic centimetre is equal to nearly 17 minims (16·896)

1 *milimetre* measures in length 0·0393 inches
1 *centimetre* „ „ „ 0·393 „
1 *decimetre* „ „ „ 3·937 „
1 *metre* „ „ „ 39·370 „

HOW TO LEARN PHOTOGRAPHY.

PART I.

INTRODUCTION.

RESPECTED PUPIL,

I PROPOSE, in a simple and familiar manner, to introduce you to the wondrous and fascinating ART OF PHOTOGRAPHY. I take for granted that you are entirely unacquainted with it, and that you are anxious to learn. Before proceeding, however, to the practical portion, I wish to impress on your mind a few of the leading principles.

The word PHOTOGRAPHY means drawing, engraving, or writing by Light.

You are, doubtless, aware that white light—light from the sun, for instance—is composed of three different colours—Yellow, Red, and Blue: it also possesses three distinct properties—Illuminating, Heating, and Chemical powers. These three powers are singularly connected with the three colours. The Illuminating property exists mainly in the Yellow rays—the Heating property in the Red—and the Chemical in the Blue or Violet rays.

With the Illuminating power you are daily familiar; the July sun gives certain proof of its Heating power; and it is your present purpose to learn that all Photography is based on its Chemical power.

For the full explanation of these facts I must refer you to Hunt's "Researches on Light;" but I mention, in illustration, that glass stained with copper and washed on one side with a colourless solution of alum, freely admits the rays of light, but obstructs 95 per cent. of heat; while a slice of black mica allows the heating, but prevents the light-giving rays to pass. Dark blue glass stops back almost entirely both heating and illuminating rays, but permits free passage to chemical or photographic power; and yellow or orange glass, on the contrary, admits light and heat, but denies passage to the blue or photographic rays.

Strictly speaking, then, it is not LIGHT—*the illuminating agency*—that is the cause of photographic action, but an active principle associated with it, and which is connected principally with the weakest illuminating and even *invisible* rays. This PHOTOGRAPHING POWER, then, that is associated with Light, but which is *not* Light, is termed ACTINISM.

The daily experience of every photographer proves, that though these two active principles, Light and Actinism, are constantly associated together, yet that they often exist in very different proportions to each other. There may be a brilliant light with but moderate actinic power, or a dull light and considerable photographic energy. In the autumn, when the sun's light and heat are at their maximum, the actinic power is by no means great. In winter, though the light be rather bright, the photographic power is always dull; while in early spring, before the sun has acquired his full strength, the actinic influence is relatively the most powerful in the whole year.

But in photographing from coloured objects, these facts will be more strongly impressed on your mind. When

brilliantly-lighted yellow objects "come out" dark, and dimly-lighted blue ones will appear bright, you will remember the reason,—that the former reflect abundance of light, and but little actinism; whereas the latter throw back little light, but much actinism: and that Actinism, not Light, is the real picture-producing power.

The general term Photography embraces many processes of producing pictures, but the particular method I intend teaching you—the Collodion Process—has supplanted nearly all the others, it being not only the most perfect and comprehensive, but also the most simple.

Pictures by this process are taken on glass, and are either *Positive* or *Negative*. These terms will be explained hereafter, when the processes are described; and it is only necessary now, before we commence actual operations, to impress on you that photography, from beginning to end, consists of a series of delicate chemical experiments, the successful operation of which depends apparently on many minute causes, which, if attended to, will produce the desired end; but which, if neglected, either from ignorance or carelessness, will as certainly cause failure and disappointment.

You must be very exact in mixing your solutions, and in using only perfectly clean vessels to put them in.

Cultivate the habit of noticing carefully all that you do; for as there is no such thing as *chance* in Photography, you must clearly understand that when you fail, you do something different to when you succeed, and that this something *causes* the failure. As your natural desire will be to avoid failures, you must try to discover these causes, that you may avoid them; and if you proceed in this manner you will certainly become a good and intelligent Photographer.

THE APPARATUS AND CHEMICALS NECESSARY.

The first thing is to obtain a Set of Apparatus. Beginners too frequently get a common cheap one, and are surrounded with unnecessary difficulties from this cause alone. There is no reason that the apparatus should be very expensive, but each article should be good of its kind. The quantity you will require will depend on the branch to which you devote yourself. A set for producing the usual sized Glass Positives will require the fewest articles. For the production of Negatives and Printing them on paper—a much higher branch of the art—more apparatus will be necessary. Should you wish to be equally well furnished for producing Portraits and Landscapes, a full equipment will be necessary. The following comprises a complete set, equally adapted for all purposes, together with a list of Chemicals, the quantities being calculated for the $8\frac{1}{2}$ by $6\frac{1}{2}$ inches, or "*whole-plate*" size. Should there be more articles enumerated than you think you will require, you must consult with some photographic friend, or explain to the person of whom you make your purchase the description and size of pictures you wish to take, and you will be advised what articles to omit.

A Lens for Landscape and Architecture.

A well-made accordion-body Landscape Camera.

A light, strong, but portable Tripod Stand for ditto.

A travelling Glass Bath with water-tight top.

A portable Dark Tent, for working in the open air.

A Double Achromatic Portrait Lens, fitted with "Waterhouse" Central Diaphragms.

A substantial square Mahogany Camera for in-door work.

A strong, well-made Camera Stand for in-door work.

A Head-rest for attachment to Chair Backs.

A strong Iron ditto for Standing Figures.
Three Plate Boxes, 24 grooves, to suit the sizes of the Camera.
Patent Plate-Glasses to fill the above.
Set of Scales and Weights, with Glass Pans.
1 Plate-cleaning Holder.
1 or more stout Oak Printing-Frames.
1 Pneumatic Plate-holder for large Plates.
1 Developing Stand for ditto.
2 or more Porcelain Dishes.
1 Gutta-percha Tray, to be used for Hyposulphite of Soda only.
1 large and 1 small Glass Funnel.
1 Gutta-percha Funnel, medium size.
1 each 20 oz., 5 oz., 2 oz., and 60 minim, Graduated Glass Measure.
1 Four oz. tall Graduated Collodion Bottle.
1 Diamond for cutting Glass Plates.
1 Horn and 1 Boxwood Pincers.
1 Silver-bath Meter, for estimating the Strength of Silver Solutions for Bath or Printing.
A few Glass Stirring Rods.
Linen Cloths, and clean Chamois Leather.
A few wide and narrow-mouthed Bottles.
A black velvet Focussing Cloth, about one yard square.

LIST OF CHEMICALS.

20 oz. Bromo-iodized Negative Collodion.
20 oz. Positive Collodion.
5 oz. Recrystallized Nitrate of Silver.
1 oz. Pyrogallic Acid.

1 oz. Citric Acid.
1 lb. Protosulphate of Iron.
1 lb. Hyposulphite of Soda.
15 gr. Chloride of Gold.
4 oz. Kaolin.
4 oz. Cyanide of Potassium.
5 oz. Glacial Acetic Acid.
5 oz. Alcohol.
1 bottle Crystal Varnish.
1 ditto Spirit do.
4 oz. Acetate of Soda.
1 oz. Bi-carbonate do.
1 bottle Black Varnish.
1 ditto Plate-cleaning Solution.
1 quire highly Albumenized Paper.
1 „ white Blotting Paper.
1 book Litmus Paper.
1 packet of large round Filter Papers.
1 ditto small.

It is not necessary that you should get the chemicals in exactly the quantities given above, and for sizes below 8½ by 6½ in. smaller portions will do; yet it is not well to begin with too small a stock, as from your inexperience you will be very apt to spill and waste a quantity at first; and if you reside in a country district you may experience a difficulty in obtaining articles sufficiently pure for your use. As a rule, it is better to buy them of those persons who supply photographic materials, from whom you will obtain them cheaper and better than from local chemists and druggists.

HOW TO PREPARE THE DARK ROOM.

HAVING selected your Apparatus and Chemicals, the next thing is to prepare a room in which to conduct your principal operations. This is technically called a *dark room*, though, except in a chemical sense, there is no reason that it should be very dark.

Many persons imagine that any cupboard, or out of the way corner, will do to prepare plates in: this is a mistake, and if you can select a room sufficiently large in which you can move about freely, it will be much better than being cooped up and crippled in your actions. Moreover, in warm weather, the fumes from the chemicals will be injurious to your health, if the chamber be too small and ill-ventilated. Everything that can be spared should be removed from the room, and nothing allowed to remain that can be injured by chemicals being spilt upon. It should be kept very clean, for dust and dirt are great enemies to good photography. Oilcloth or bare boards are best for the floor, not carpet. A convenient range of shelves should be made round the room, and some hooks provided for hanging cloths and towels on.

You will remember I explained that the Actinic force that accompanies Light resides mainly in the blue, and scarcely at all in the yellow rays; and photographers ingeniously take advantage of this fact by illuminating their "dark" rooms with this non-photographic light, and thus see how to prepare their most sensitive plates. Every aperture and chink that admits white light must be carefully stopped up.

If there be more windows than one, they must be blocked out, and the remaining one covered with three folds of yellow calico; or, better still, have a hinged frame made to cover

the window, and glaze this frame with dark yellow or orange glass, so that you can have yellow or white light in your room at will. If a window is not obtainable, a gas light, a lamp, or even a candle may be used, if a yellow glass be provided. An ordinary moderator lamp, with a yellow paper screen over it, makes a very fair light for the *dark* room. Persons usually make the room for preparing their plates too dark. This is a mistake; at least sufficient light should be admitted to enable you to see what you do, but it is important that this light be quite yellow. Should you commit the error of admitting too much light, you will find under the head of "Defects, Failures, and Remedies," the proper method of proceeding.

Near the window or lamp, a strong shelf or table should be placed, to hold the bottles which you will require; and close at hand you must have a supply of water. If you can have the water laid on, with regular tap and sink, your arrangements will be perfect; failing this, you may have a cask or other vessel with a tap in it, filling it up with water as you need; or, on an emergency, use a jug, and a pail to receive your slops. Have a towel and soap conveniently placed to wash your hands with.

HOW TO BEGIN WORK.

Your room being prepared, you are ready to make a commencement, and your natural desire will doubtless be to take a portrait.

But as you are a beginner, you should commence with the easiest thing, and to take a good portrait is one of the most difficult things in photography. The proper proceeding is to set up a plaster cast, engraving, porcelain statuette, or similar still-life object, and practise upon it, being prepared for many

failures arising from your ignorance and clumsiness, before you attempt portraiture. You should try picture after picture, noticing carefully the faults you commit in one, so as to avoid them in the next.

In this way, by patience, observation, and practice, you will speedily gain such experience as will make your new occupation a pleasure. Above all things, do not expect to produce good pictures all at once; and be not discouraged with failures, but try to understand why you fail.

In setting up an inanimate object to copy, the risks of failure are less, for it will not move or alter its expression, or make remarks if you do not succeed. When brother Tom, or friend Harry, is called in to sit, the case will be different; they will be full of fun and jokes, will most likely move at the critical moment, and say disparaging things when they find the picture a failure. All this will confuse you, and cause you to omit things you ought to have done, and do abundance of things you ought not to have done, and dishearten you in your early progress.

You had better, therefore, set up a plaster cast bust—one painted stone-colour will be best—such as those of Shakspeare, which are so abundant, and, using this as a model, work frequently at it, until you have sufficient mastery of your instrument and materials to produce, with moderate certainty, a passably good picture; then you may proceed to portraiture.

Place your object in a good light: a glass-house built for the purpose is the best; but this you may not at present be able to obtain. A well-lighted apartment will do, if you use a white screen—a sheet thrown over a clothes-horse—to reflect light upon the shaded side. A background may

be formed by hanging some quiet drapery a little distance behind your object.

Now get out your portrait lens, and after wiping carefully the surfaces of the glasses with a clean silk handkerchief or chamois leather, screw it on to your portrait camera, and place them both on your heavy camera-stand opposite to your object. The ground-glass of your camera should have the sizes of the glass plates marked on it in squares, corresponding to the holders in your dark slide. Place your stand and camera so that the lens is opposite to about the centre of your object, and move the stand and camera backwards or forwards until the image of the bust is of the size, and occupies the place on your ground-glass that you wish the image to do on the plate you are going to use, remarking that the nearer the camera is to the object, the larger the object will be, and *vice versa*. Lay the focussing-cloth on the camera; put your head under the cloth, and you will more clearly see the image on the ground-glass. Slide in or out the inner body of the camera until the image is seen quite distinctly, then fix the camera with the screw provided. While your head is still under the focussing-cloth, pass your hand round to the lens, and move the rack backwards and forwards till you find the point at which it is most distinct.* It is then said to be "in focus," or "sharp."

You may now return to your dark room, and prepare your chemicals for "Glass Positives," these being the most easily produced photographs.

* These instructions for adjusting the focus apply to the common cameras. The best kind of camera is provided with an endless screw arrangement, or a rack and pinion, by which the adjustment is made more easily and perfectly.

HOW TO TAKE GLASS POSITIVES.

THE chemicals required are—

Positive collodion.
Nitrate of silver solution.
Plate-cleaning do.
Developing do.
Fixing do.
Crystal Varnish
Black do.

The positive collodion you will purchase ready prepared. When required for use, pour three or four ounces into the tall collodion bottle; and when you have done for the day, return what remains back into the stock-bottle, that it may settle. In this manner you can always use from a clear quantity, and avoid those spots and defects which arise from a turbid or unsettled collodion.

The nitrate bath solution is one of the highest importance. To know how much solution to mix, fill your bath with water to within an inch of the top, and measure how much it holds. Suppose it to contain 25 fluid ounces*; as 35 grains of nitrate of silver to one fluid ounce of distilled water is the

* It is important to notice that in all photographic formulæ, where ounces of fluid are named, that *fluid* ounces are meant, and that the glass measures are graduated for the purpose. When solids are named, *Apothecaries* weight is meant. But the materials are sold to you by *Avoirdupois* weight; and as the ounce of the latter is not so heavy as that of the former, this fact must be carefully remembered, or disputes with shopkeepers, and errors in mixing your solutions, will arise. The Apothecaries ounce weighs 480 grains, and the ounce Avoirdupois but 437½ grains. It is better, therefore, in mixing nitrate of silver solutions, to estimate the quantity required in *grains*, remembering that the purchased ounce of nitrate of silver will never contain more than 437½.

proper strength, 2 ounces of the nitrate will be required to form 25 fluid ounces of the necessary solution. Dissolve the silver in 4 ounces of distilled water, or boiled rain-water, then add a quarter of an ounce of positive collodion to it, shake it well for a few minutes, and add 21 ounces more of distilled water.

The solution will now be a pale milky colour, and requires filtering. Should it not run through quite clear, it must be re-filtered. Add one drop of pure nitric acid to every 3 ounces of nitrate solution, and then it will be ready for use.

Developing Solution.

Protosulphate of iron	100 grains
Glacial acetic acid...	0½ ounce
Water	10 ounces
Nitric acid...	5 minims
Alcohol	0½ ounce.

Dissolve the crystals, and if the solution be not quite clear, filter it, then add the alcohol and acids. It will keep good a considerable time.

Fixing Solution.

Cyanide of potassium...	60 grains
Water...	6 ounces.

Dissolve, and it is ready for use.

Let each of these solutions be distinctly labelled, and cork them well when they are out of use. The fixing solution had better be legibly marked "Poison," to prevent any accidents. It should also be particularly kept out of reach of children, as it is a most deadly poison, despite its rather attractive smell.

How to Clean the Glass.

Certain fixed sizes are used by photographers, and the glasses are sold cut ready for use.

The description of glass known as "Flatted Crown" is well suited for positives, but, before using, it requires carefully cleaning. The sharp edges should be first removed with a fine file, or by drawing the edge of one piece over the edge of another; then lay the glass on a clean flat surface, or put it in a "plate-cleaning holder," and pour a few drops of the "plate-cleaning solution" in the middle. Rub it carefully over every part with a bit of clean soft rag: turn the glass over, and do the other side the same. Then polish each side with a clean cloth, and finish with a soft chamois leather kept expressly for this purpose. Now breathe on the glass; and if the breath deposits evenly, the plate is clean. If the plate, however, shows patches and marks, it must be re-cleaned. Let the edges be carefully wiped, and the plate is ready for use. This amount of cleaning will generally be sufficient for new glasses, but when they have been used they require more labour. They must then be well washed under the tap, to get rid of all collodion and chemicals, and be wiped on cloths kept expressly for the purpose. No soap, only plain soda and water, must be used in washing these cloths. Should the plates have been varnished, they must be soaked for some hours in a saturated solution of washing soda, till the varnish and film come freely off. The glasses must then be well washed, and treated as already described. It is a good plan, when working, to have a dish of water at hand, and to place the spoilt pictures in it at once while they are wet, and at the end of the day to wash them all, and put them away

clean. By thus not allowing the films to dry on the glasses, they are much easier cleaned, and fewer failures will arise from dirty glasses.

Collodion is a good material for cleaning glasses when they are not very dirty. Pour a few drops on the glass, and well rub it with a clean cloth, and you will entirely remove all grease. A hint may thus be taken how to use up waste collodion.*

Pouring on the Collodion.

Remove the stopper from the bottle, and wipe from the lip any dust or dry film adhering; and, holding the plate horizontally by one corner with the thumb and finger of the left hand, pour steadily into the middle of the plate as much collodion as will half cover it. Then gradually incline the plate so that the collodion flows to each corner, not allowing it quite to touch the thumb; then steadily pour back the excess from one corner into the bottle, and while the plate rests on the mouth of the bottle, move the plate backwards and forwards to prevent the collodion setting in crapy lines. Perform this operation coolly and steadily, and try to avoid spilling any of the collodion. A little practice will make it easy. When the collodion is set—usually in a few seconds—the plate is ready to be immersed in the nitrate of silver bath. Lift the dipper up, and place the back of your plate on it—it will adhere by capillary attraction—and immerse plate and dipper into the bath solution with one steady dip, and cover it over to keep it from light and dust. If there be the least hesitation or stop while the plate is being immersed, there will be a line

* For further Instructions on Cleaning Glass, see Part III.

marked across the plate. To know how long to keep the plate before putting it in the bath, after it is collodionized, is a point that you will gain by experience; but it depends on many circumstances, such as the nature of the collodion and the temperature; but this rule will guide you; if you put the plate in too soon, streaks and marks will be formed, commencing from where it first touched the silver solution. If you do not immerse it soon enough, the part of the plate that has become too dry will be insensitive, and will show a dark mark. By noticing these points, you can judge whether you have made an error in the time of immersion. The plate must remain in the bath in summer time about two minutes, and in winter from five to ten.

While the plate is in the bath, you must get ready your dark slide, and see that there is no dirt in it. Up to this point you may use white light; you must now shut your door, and see that only yellow light illuminates the room. Lift the plate up and down in the bath several times by means of the dipper, and the agitation of the solution will remove the oily-looking lines on the surface. Allow it to remain in the bath till all apparent greasiness is removed, and the film has become creamy-looking. Then take it off the dipper, and handling it as carefully as possible—chiefly by the corner uncollodionized—let it drain for a few seconds on clean blotting-paper, and then lay it, collodion side downwards, into your dark slide, the silver wire corners supporting it by the four corners. Close up your dark slide, and your plate is ready for use.

You may now return to your plaster cast, and, removing the ground-glass frame from the camera, insert the dark slide in the place. Cover the lens with the cap, raise the shutter of

the dark slide, and gently remove the lens cap, so as not to shake the camera: thus the light will be admitted to the sensitive plate. Experience can alone determine the length of the "exposure." The brilliancy of the light, colour of object, kind of lens, nature of collodion, time of day, and even the period of the year, are all modifying circumstances.

Suppose you allow ten seconds. Count the time exactly, and replace the cap on the lens. Next shut down the shutter of the slide, and take it into the dark room. Close the door, and noticing that no white light is admitted, remove the plate carefully from the dark slide. The nitrate solution that has accumulated at the bottom drain off with clean blotting-paper. Put about an ounce of developing solution into a clean measure glass, and holding the plate horizontally by the bare corner, collodion side upwards, pour steadily but quickly along the bottom edge of the plate sufficient to easily cover it; gently incline the plate to allow the developing solution to flow uniformly backwards and forwards. Watch the "coming out" of the image. The image will quickly appear; first the parts most strongly lighted will show themselves, next the shaded portions, and when these are fully out, turn off the solution, and wash the plate well, by allowing the water from the tap to flow over it for not less than one minute, or until all the greasy lines disappear.

Lay the plate in a shallow gutta-percha dish kept for the purpose, and pour quickly over it sufficient of the fixing solution to cover it. Directly the yellow film of iodide of silver is dissolved, the plate must be lifted out and well washed. When the plate goes into the fixing solution, white light may freely be admitted. The fixing solution

must be put back into its bottle, and may be used as long as it continues to dissolve the yellow film.

If the exposure be correct, and you have developed properly, you will now have a nice picture of your bust.* Your plate may be dried spontaneously or by heat. When dry, pour on the *glass* side the black varnish, just as you did the collodion, and drain off at one corner, taking care it does not flow over to the face of the picture; or, better and easier, use a black varnish made expressly for the purpose, which is to be laid on with a brush, and which dries quickly, or may be assisted with heat. The collodion surface now requires varnishing, to protect it from atmospheric action. Remove carefully with a camel-hair brush any dust or dirt on the picture, and pour crystal varnish over it as you did the collodion. Drain it, and, when dry, your picture is finished, and ready to be mounted.

You have now passed through the various operations, and it only requires practice and observation to make them familiar to you. Having obtained this practice, the bust may be removed, and a friend being placed in its stead, you may, by applying the same manipulations, produce a portrait. Let him sit in an easy, graceful position, and, if necessary, steady his head by the use of the head-rest. Let him look at some dark object, and allow him to wink his eyes freely during the sitting, but caution him to be quite steady in all other respects.

* If the picture be not perfect, refer to the chapter on "Defects Failures, and Remedies," for further instructions.

HOW TO TAKE NEGATIVES.

The pictures produced by the above method have the disadvantage that a separate sitting is required for every one; this, together with the fragility of the material, has caused the process to be less generally followed than the more complex one, where a *negative* is first obtained, from which an indefinite number of paper pictures can be produced. The practice, however, you acquire in producing glass positives will be extremely useful in producing negatives, as, up to a certain point, the manipulations are similar.

You must clearly understand the difference between a Negative and a Glass Positive. Every glass picture, to a certain extent, partakes of the nature of both; but a positive is a picture done at one operation, and complete in itself; whilst a negative is not so much a picture, as the means of producing one.

Glass positives are examined by reflected, negatives by transmitted, light; the one you hold *down* to look *at*, the other you hold *up* to look *through*; the former is black-varnished to make it opaque, the latter clear varnished to give transparency. The one shows natural objects as they are—lights for lights and darks for darks; the other, just the reverse—faces, hands, and linen very dark, and black drapery quite clear. Hold a picture of each kind up to the light and look *through* them, the positive will appear thin and transparent, the negative dense and opaque; turn them down and look *at* them, the positive is clear and distinct, the negative misty and confused. The two kinds of pictures are so different, that you must judge each by its own rules; for what is a fault in one, may be a merit in the other. In other words, a

negative is a glass picture produced by somewhat similar means to a positive, only that in the development a much thicker and denser deposit is formed.

In fact, the negative is to the photographer what the types are to the printer; and as the latter, you know, are arranged just the contrary of the impression that is taken from them, so must the photographer's negatives—his types—be the reverse of his prints. The analogy between the two processes is so considerable, that the production of paper pictures by the aid of negatives is always termed "printing."

It will be a great assistance to you, if you can obtain from some photographer a negative that you can keep by you, to compare with your own, until you have acquired experience to know how to judge for yourself.

The same apparatus serves for the production of negatives as positives, but some of the chemicals are different; those that you require are—

Bromo-iodized negative collodion
Nitrate of silver bath solution
Developing do.
Fixing do.
Spirit varnish.

The *Bromo-iodized Negative Collodion* is rather different in its preparation to positive collodion, and is better adapted for giving dense pictures. It is often supplied as plain collodion and iodizing solution. It is made ready for use by mixing three parts by measure of the former to one of the latter. It is better to mix it a few hours before using, so that time be allowed for floating particles to subside.

Nitrate of Silver Bath Solution.—The same you used for positives will not do for negatives.

Recrystallized nitrate of silver ... 2 ounces
Distilled or boiled rain-water ... 25 „

Dissolve the silver in four ounces of the water; dissolve two grains of iodide of potassium in one ounce of the water, and add it to the four ounces of silver solution; agitate till the yellow precipitate first formed is dissolved. Add a few drops of a saturated solution of bi-carbonate of soda, agitating well between each addition, until the silver solution becomes quite milky, then add the remaining 20 ounces of distilled water. Filter, and add half a drachm of glacial acetic acid, and your nitrate bath is ready for use. Fill it up from time to time with a plain solution of nitrate of silver, 40 grains to the ounce.

DEVELOPING SOLUTION FOR NEGATIVES.

Protosulphate of iron ... ... 150 grains
Glacial acetic acid ... ... 0½ ounce
Alcohol* ... ... 1 „
Distilled water ... ... 10 ounces.

This solution gradually acquires a sherry colour, but its quality remains equally good. It should be filtered before using.

FIXING SOLUTION.

Hyposulphite of soda ... ... 5 ounces
Water ... ... 5 „

This solution may be used until it loses its power of fixing the negative. It soon becomes discoloured, but that is of no consequence.

* To know the exact use of alcohol in the developer, see the article on that subject in Part III.

"Patent Plate" is the proper glass to use for negatives, as the "crown" is not flat enough. It requires the same careful cleaning as for positives. As it is more difficult to produce clean negatives than positives, you had better accustom yourself to use a glass one size larger than you require, so that the defects, which usually occur on the margin of the plate, may not spoil your picture.

Pour the collodion on the plate, sensitize, drain, and place it in the dark slide carefully, and according to the directions given for glass positives.

The same difficulty occurs with negatives, in giving any rule for the length of exposure, as in positives; the appearance of the plate during development is a useful guide, but they always require at least twice as long time as for positives. Be very careful, when your plate is in the dark slide, to keep it erect, and to handle it gently. Never knock it against anything, or it will be covered with abundance of spots from particles of dust and dirt falling on it. When in the dark room, take the plate out as carefully as before, and remove, with clean blotting-paper, the nitrate solution that has accumulated at the bottom; and holding it by the corner, pour over it the developing solution, and in a few seconds the image will appear. After a little experience you will be able to judge, by the manner in which the image makes its appearance, whether you have given the proper exposure in the camera.

If it start out at once, directly the developer has flowed over the plate, the exposure has been too long; but if the image comes out slowly and reluctantly, and you have difficulty in making the deepest shades appear, it has not been exposed long enough.

The happy medium between these two is the correct time. When this has been given, the image makes its appearance steadily and gradually,—first the high lights, next the light shades, and finally the deep shadows. Suppose it a portrait of a gentleman—the shirt-front, face, and hands are first seen; the light folds of the drapery next show themselves; and lastly, the details in the darkest parts. If it were a positive, you would have poured the developer off before these last were seen; but being a negative, you must carry it on until the whole of the details are clearly out, then pour the solution off the plate into your measure-glass, and hold your plate up to the light and look through it. You will now see the image as a negative,—the whites all dark, and dark portions nearly transparent; and if the picture appear in proper harmony, making allowance for reversed effects, the lighter portions being nearly opaque, and the darker parts very clear —*but the whole picture full of gradations and half-tones, with scarcely any parts entirely opaque, and very few clear glass*— then the development is complete; if, however, the picture presents somewhat this appearance, but is deficient in opacity of deposit, or "density," then pour off the iron solution, and wash the plate well. Next pour over the plate as much as will comfortably cover it of the following —

NEGATIVE INTENSIFYING SOLUTION.

Pyrogallic acid	3 grains
Citric do.	1 grain
Glacial acetic do.	0½ drachm
Distilled water	1 ounce.

When this solution has thoroughly mixed with the water on the plate, pour it back into the measure-glass, and add a few drops of nitrate of silver solution to it (30 grains to the ounce

of water), mix, and pour again over the plate ; the image will speedily begin to intensify—that is, the silver will be deposited over the various parts where the light has acted. This intensifying must be continued until the parts of the negative most lighted have the requisite opacity.

This solution sometimes becomes turbid and muddy before the picture is dense enough. In such a case, pour it away, and renew with some fresh intensifying solution and silver, and proceed as before. This may be repeated many times, if needed, until the required effect is produced. Here is, perhaps, the most difficult thing you have to learn—to know how far to go, and when to stop; how to gain intensity enough to produce a vigorous negative, and yet to avoid making it too dense, and losing half-tone. As a rule, beginners over-develop their positives, and under-develop their negatives.

But it is possible to intensify too much, and make the picture so dense that you cannot print through it. You must watch the kind of prints that different negatives produce, and when you find one that gives a brilliant yet soft image—for the real test of a negative is the kind of print it produces—study that negative well, observe the degree of opacity it has, and, keeping it as a standard, try and produce all others like it. In this way you can train and educate yourself to produce good negatives.

The development being finished, wash the plate and lay it in the gutta-percha dish; pour the fixing solution over, and when the yellow iodide is dissolved out, give it a careful and copious washing; for if any of the hyposulphite of soda remain in the film, it will crystallize and spoil it.

Your picture now being washed, you may calmly examine

it. If it show as a moderately good but over-exposed positive, with a red and green pearly tint, and on looking through it abundance of half-tones, both in the opaque and transparent parts, are seen, you may consider you have a correctly-exposed and well-developed negative, and one from which you may anticipate brilliant prints.

If, however, the negative appear as a good positive with brilliant blacks, but rather chalky whites, and on looking through, if these latter are very dense without half-tone, and the former almost like bare glass, then your picture is defective, and will only produce a hard black and white print; the fault being that it was not long enough exposed in the camera.

Should it, however, appear as a very much over-exposed positive, the whole plate having a grey film over it, obscuring the image, and on looking *through*, the details of the shadows are almost as intense as the white linen, and the whole picture is deficient in contrast, then it has been over-exposed.

The two instances I have pointed out are extreme ones: it is your object to avoid each; but of the two errors, under-exposure is the worst, for by careful printing you may get a passable proof from an over-exposed negative; but no dexterity will avail with an under-exposed one, and unfortunately, beginners' negatives, from their great desire to "work quick," have too frequently this latter fault.

HOW TO VARNISH THE NEGATIVE.

After the plate has been well washed and dried, it is ready to varnish. If only a few prints are wanted, and you do not intend to keep the negative, you may use crystal varnish. If, however, you value your negative, and purpose producing many prints from it, the crystal varnish will not give sufficient

protection, and you must use a spirit varnish, which will produce a much harder surface. To use this spirit varnish, warm the negative before a fire uniformly all over, as hot as the back of the hand will bear, then pour the varnish on like collodion, drain off, and dry it with a similar heat. The proper degree of heat to use will be acquired by a little experience; if the plate be made too hot, the varnish will not flow uniformly over, but will run and dry into irregular streaks. If it be not hot enough, the surface will dry dull and dead. With the medium heat the film will dry with a hard, glassy surface. When cold, your negative is ready to be printed from.

HOW TO PRINT ON ALBUMENIZED PAPER.

THE remark has been made, that a *negative* is not so much a picture as the means of producing one; and your next proceeding is to use the negative to produce an impression on paper. This operation is called "printing," and the paper picture produced is termed a "print." There are two kinds of paper employed, plain and albumenized. The former yields a dull surface, like an engraving, and is chiefly used for pictures that have to be coloured; the latter has a glazed surface, and is the kind in general use for almost every kind of photograph, as it gives a more brilliant picture, and yields finer definition.

The apparatus necessary for printing are—

Printing-frames.
Porcelain dishes.
Silver-bath tester.
Gutta-percha dish.
American pegs.
Boxwood pincers.

The materials required for the operation are—

Albumenized paper.
Plain salted do.
Nitrate of silver solution.
Kaolin.
Chloride of gold.
Acetate of soda.
Hyposulphite of soda.

Albumenized Paper.—This material you can purchase ready prepared. There are two principal kinds, known as *Rive* and *Saxe*. The former is a French paper, and has the highest glaze and finest surface; but the latter, a German one, is the most uniform in its general texture.

Plain Paper.—Plain paper requires preparing, or "salting," before being ready for use, or it may be purchased already salted. It is not a difficult thing to "salt" your own paper. Procure some sheets of Saxe paper, and immerse them for five minutes, removing air-bubbles, in the following solution:—

Chloride of ammonium	...	...	100 grains
Chloride of barium	...	...	100 „
Citrate of soda	...	...	20 „
Water	...	...	20 ounces.

Hang the sheets up to dry, and they are ready for the next operation. This may be performed in ordinary daylight.

Nitrate of Silver Solution.—Whether you intend to print on plain or albumenized paper, you must make a fresh silver solution, as the one you have used for your positives and negatives is not adapted for printing; neither will the one you are about to make serve the former purposes; they must be kept for their separate uses. Measure how much fluid one of your porcelain dishes contains when filled half an inch

high, and make so much nitrate of silver solution, 60 grains to the fluid ounce. The crystals have simply to be dissolved, and the solution is ready for use. It speedily becomes discoloured; but if you adopt the plan of keeping some kaolin (an ounce or two), in a bottle, and pour your silver solution into it after each time of using, shaking it up well, the kaolin, in subsiding, will carry down with it the colouring matter. This solution rapidly loses its strength; therefore, each time before using, immerse the silver-bath meter, and note the figure on the tube where the surface of the fluid touches, and it will indicate the number of grains of nitrate of silver contained in each ounce of solution. Thus, if it stand at 30, 40, or 60, each ounce may be considered to contain so many grains of the nitrate. You must never sensitize your paper without being assured that your solution contains 60 grains per ounce. It is not sufficient that you originally mix it this strength, but it must be continued so; and until you have experience, you will scarcely believe how rapidly the silver salt is abstracted by the act of sensitizing the paper. If you adhere to the use of this little instrument, you will always be kept right; but never forget, that if this solution be not kept up to this strength, you may have difficulty in obtaining brilliant and vigorous prints.

Chloride of Gold.—This valuable substance is generally sold in bottles or tubes containing 15 grains. It is very deliquescent, and unless hermetically sealed, can only be kept in solution. Break your tube, and dissolve the contents in a bottle containing two ounces of water, and label it accordingly.

Hyposulphite of Soda.—Dissolve two ounces in sixteen ounces of water, and label the solution. Make a fresh quantity for every batch of prints.

HOW TO SENSITIZE THE PAPER.

FILL your dish to the depth of not less than half-an-inch with the 60-grain nitrate of silver solution already named. Cut your paper to convenient sizes suitable to your negatives, and lay it, if it is albumenized paper, on its glazed or albumenized side downwards on the surface of the silver solution; if it is plain paper, lay it on its smoothest side. When it has lain for about a minute, lift up one corner with the pincers, and if there are any air-bubbles, remove them; replace the sheet, and allow it to remain five minutes on the solution, then lift it off, taking care no solution runs over the back, and suspend it, with an American peg, to a line, in a closet or other dark place, away from the light, where it can dry spontaneously. It is then ready for use.

Your paper ready, place your negative in the printing-frame, collodion side uppermost—be sure the glass is quite clean—and lay the paper on it, prepared surface downwards; put a few sheets of blotting-paper behind it; next put the hinged back in its place, and secure the whole tightly with the screws or other fastenings provided.

It is essential that the paper should be in very close contact with the negative to produce a "sharp" print, and you must observe that this pressure is uniform, to prevent breaking it.

Expose it to the light, and allow it to remain until printed. How long this operation will take depends on the power of the light and the density of the negative. In summer, a very short period is sufficient; and in winter, a whole day or longer may be required. To know how it is proceeding, undo the fastenings *on one side of the frame*; and by lifting up half of the hinged back, you can, without disturbing the position

of the negative and paper, examine the latter, and observe its progress. First, the general outline is marked; then, the deep shadows; next, the lighter shades; and, finally, the delicate half-tones. By these latter you must be guided. You must print till they are not only clearly out, but a few shades deeper than you would like them, because in the subsequent operations they will become lighter, and unless you make this allowance, your print, when finished, will not be deep enough. A little experience will tell you how dark you should print. In printing portraits, you must judge entirely by the *head*; get out all the half-tones clear and distinct, so that the ultimate picture shall show the features nice and round, not buried in black shade from being over-printed, or pale and flat from under-printing, but just such soft gradations as will make a pleasing likeness. This depth obtained, take it out of the printing-frame, and it is ready to be *toned* and *fixed*. The operations of preparing the paper, putting it into the printing-frame, examining it, and taking it out, together with the toning, should all be done either in yellow or very dull white light; for although the excited paper is not nearly so sensitive as collodion, yet a strong light, especially sunshine, will quickly spoil it for good printing.

HOW TO TONE THE PRINTS.

If you are producing several prints, you may wait till they are all ready, keeping those first done in a drawer or other place secluded from light; but they should be toned and fixed the same day they are printed, for although these operations may be deferred, the results are seldom so good. When ready, immerse them in a dish of clean water, removing air-bubbles, and move them about, that the water may get freely

between; allow them to remain five minutes; pour the water away, and refill the dish, and again wash for another five minutes, moving them about as before; change the water a third time; this last time the water should only be slightly milky; if it is more than this, the prints must be further washed.

TONING BATH.

Chloride of gold	$7\frac{1}{2}$ grains
Acetate of soda	$\frac{1}{4}$ ounce
Carbonate of soda	$\frac{1}{4}$ „
Distilled water	40 ounces.

This bath may be mixed in the above quantity, as it will keep for a considerable time. It should be prepared a day or two before being used. When required for use, pour enough in a dish to well cover the prints. Take the prints from the last washing water, and immerse them one at a time; keep them moving about, and remove air-bubbles. Until you acquire experience, you had better not have more than three or four prints in at a time. They must be closely watched, for they speedily change from their reddish-brown to a purple tint; and if they have been printed deeply enough, the shades will pass to a purple black, while the whites will assume a delicate rosy hue. Some little experience is required to know when to take them out, but you may be guided by the general appearance as seen by looking *through* them, holding them up to the light. If they are purple when thus examined, they may be removed into a dish of clean water, to remain until they are all toned and ready to be fixed.

According to the depth to which you have printed, and the length of time they have been in the toning solution, so will the colour be. If you wish a rich chesnut brown, a very

little toning will suffice; if you like a purple brown, tone deeper; and if a dark purple black, you must print and tone very deep. The colour of your prints will materially depend on your negatives. With a well-defined, soft, yet vigorous negative, you may produce any tone; but from weak negatives you cannot produce good pictures. Prints kept too long in the toning solution become cold, grey, inky, weak, and flat.

If you are attentive, you will quickly gain experience enough to get, with good negatives, almost any desirable tone, by modifying the depth of printing and strength of toning. The time usually occupied is from two to five minutes. In winter time the solution may be warmed, and it will tone quicker. The preceding instructions are mainly directed to highly albumenized prints; a little modification is required for plain paper proofs; they should be printed rather darker, as they have a great tendency to bleach during toning. The toning solution should be much more dilute than for albumen prints.*

HOW TO FIX THE PRINTS.

Into your gutta-percha dish—which you must keep expressly for this purpose—pour your fixing solution of hyposulphite of soda. Immerse your prints in it, and allow them to remain for fifteen minutes, separating and moving them about, so that the solution may get freely to them all. Fresh fixing solution should be used each time, as it is unsafe to use it a second time until you have had considerable experience.

The prints will quickly change and lose some part of the

* The above directions are sufficient for the beginner; but as he acquires experience, he will be able to profit by the fuller information contained in the article on Printing, in Part III.

beautiful hue they had in the gold solution, but this tint will be restored when they are finally finished. When the time has elapsed, they must be taken out, well drained, and then be well washed, to rid them, as much as possible, of the fixing solution. For the first half-hour they should be kept in running water, and, if your circumstances will permit, should be kept in for six hours, and then dried. If you cannot give them the advantage of a running stream, change the water in which they are soaked every half-hour for the first three hours; then soak them all night, and next morning give them two or three changes, and let them be dried. This well washing is a security that your prints will not fade, for more are spoilt from neglect of this important but irksome process than from any other cause.

HOW TO MOUNT THE PRINTS.

When dry, the print will be very curly; but if ironed on the back with a clean, warm, flat iron, it will lie smooth, and then it may be cut and trimmed as taste dictates.

Hot thin glue may be used to mount them on cardboard; but starch, such as used for household purposes, and about the same consistency, is equally adapted. It should be used cold. To complete them, they should be sent to the hot-pressers, who, for a very small charge, will glaze or roll them, which will communicate a highly-finished appearance.

HOW TO PRINT BY DEVELOPMENT.

Another mode of printing is occasionally adopted where light only commences the operation, and the further production of the picture is by development. There are many

circumstances in which this mode is very useful, especially when the solar light is too weak to produce prints in the usual manner.

The results are not so fine as by direct sun-printing, and are best adapted for large and bold subjects.

Albumenized paper is not used, but salted paper, which you may purchase ready for use, or prepare for yourself as follows :—

Chloride of ammonium	90 grains
Water	10 ounces.

Immerse the paper—Towgood or Saxe is best—for five minutes, then hang up and dry; sensitize on the following bath according to the directions previously given :—

Nitrate of silver	45 grains
Glacial acetic acid	3 minims
Distilled water	1 ounce.

When dry, expose under a negative till a very faint picture is seen, then take it into the regular dark room and place it in a very clean dish; pour over it a saturated solution of gallic acid. It will take from five to twenty minutes to develop. When the print is fully out—you must get rather a strong impression, as it loses a little in fixing—wash it well in plain water, changing two or three times, then immerse in the hyposulphite fixing bath, already named, for other prints. Allow it to remain ten minutes, then wash well, obeying all the instructions already given on the same subject. Prints produced by this formula are a very good colour, and do not need toning.

DEFECTS, FAILURES, AND REMEDIES.

"Humanum est errare."

My worthy Pupil,—In the preceding instructions I have been as clear and as simple as I could, and have avoided explanations that, in your early progress, might embarrass you. That you may be successful is my ardent wish; yet, as there is no royal road to photography, it is more than probable that you will be beset with many of the troubles common to the practice of the art.

It may be a melancholy satisfaction to know that the cleverest practitioners are subject to them in common with the less skilful; the difference, however, being, that the former, by perseverance, overcome them, while the latter give up the contest, and are beaten.

If there were no difficulties to be surmounted there would be no credit in excellence, and one of the stimulants to advancement would be denied to the student of photography. The difficulties, however, that constantly arise, afford abundance of opportunity for the exercise of ingenuity, intelligence, and patience. It is sufficient to say, if you meet with few of them, deem yourself fortunate; and if you encounter many, be not discouraged, but strive to overcome them.

Generally speaking, to point out the origin of a defect is also to suggest a remedy. It is impossible to anticipate where your difficulties will be, for the experience of no two exactly agrees; but you must endeavour to *understand* the process, and to grasp the *spirit* of the directions. Above all things, resolve to be neat and clean in your manipulations,

cool in your manner, and exercise an observing eye; by these means you will certainly escape from nine out of ten of the beginner's troubles.

Whether a person shall succeed or fail in photography depends very much on the spirit with which he commences. If he think the whole process a *mechanical* one—mainly a question of apparatus, baths, and developers—he has no pleasant future. When he gets into difficulty—and he soon does—he declares his chemicals are wrong, his bath is out of order, his camera is bewitched, and rushes from shop to shop to buy the last "patent never-fail collodion," or the marvellous Greek-named lens that takes pictures in a few seconds less than no time, or some other be-puffed and be-advertised nostrum, instead of stopping at home and quietly finding out in what his trouble consisted. Possibly he may have mixed his plain collodion and iodizing solution in reversed proportions, or strengthened his nitrate bath out of the unlabelled hypo bottle, or been trying to develop with his cyanide. Such a man soon wears himself out; declares "It's no use trying, it's all chance;" and attributes the success of skilful men to the use of "secret dodges."

As a contrast, observe another man, who begins quietly and steadily, and, getting into trouble, thinks it probable that *he* is wrong, and not the chemicals; and, instead of throwing them down the sink, perseveringly proceeds, finally discovering that the same chemicals that formerly gave him bad pictures now furnish good ones, the difference being only *in the mode of using them.* A man of this stamp, taking pride in his new acquisition, and not blind to his own deficiencies, reads the Journals, joins a Photographic Society, compares notes with others who practise the art, keenly enjoys a visit to

a Photographic Exhibition, and speedily becomes an intelligent and clever manipulator.

Defects common to Glass Positives and Negatives.

A darkening of the film all over, directly the developing solution is applied.—This defect, technically called "fogging," has several sources. It may exist in a small degree, only slightly obscuring the shadows of the picture, or to so great an extent as to prevent its appearance. Fogging often troubles the young beginner, and as it arises from many causes, it is often difficult to assign it to the right one. Sometimes deleterious vapours are the reason; as, the dark room being built over a stable, and filled with reeking vapour; the room being newly painted with a slow-drying paint; a leakage of gas; a bottle of ammonia with a badly fitting cork or stopper. A remedy for any of the above is simply to remove the cause.

In extremely warm weather the developing solution is much more energetic, and fogging may thus arise from this increased energy; remedy, dilute it one-half or double the quantity of acid. The following are, however, the most usual causes of fogging:—

Alkalinity of nitrate bath; remedy, addition of acetic acid till litmus paper is *slightly* reddened.

Extreme acidity of nitrate bath; remedy, addition of oxide of silver or ammonia until litmus paper is only slightly reddened.

Omission of acetic acid in the developer; remedy obvious.

Over-exposure in the camera; remedy obvious.

Diffused light in the dark room. If yellow calico be used, it has perhaps become bleached, and must be replenished;

or additional folds must be used. Sometimes chinks of unsuspected white light are the cause; if so, they must be stopped up.

Diffused light in the camera or the dark slide, admitted through a joint giving way, or an old screw-hole, or the parts of the camera not fitting; remedy obvious.

Nitrate bath made with impure silver, or bad water; remedy, add a few drops of saturated solution of bicarbonate of soda until the bath solution remains turbid after shaking; then expose it to the sun for a few hours, and filter; acidify it if necessary.

Newly-mixed collodion will sometimes cause fogging; it then requires to be kept for a few days, when it may work clean; or it may be mixed with some older collodion, and may then be all right. Sometimes a little more acid added to the bath or the developer will be a remedy. If none of these aids are sufficient, then the collodion must be rejected.

When you make any change—such as having a new camera, a fresh nitrate of silver bath solution, a new quantity of developer, or another sample of collodion—you may be able at once to suspect and perhaps detect the cause; for if some change occurs in the nature of the pictures which did not exist before, it is very probable that this fresh circumstance is directly connected with the changed character of the pictures. Therefore, whatever it is that has been newly introduced should be carefully examined, and very probably the cause of the fogging may be discovered. When, however, you have no such clue, you must adopt a systematic method for its discovery. The following is the plan:—

First, examine your dark room, by covering your yellow window with some material that entirely excludes *all light*.

Crevices and cracks admitting white light may then be seen that before were unnoticed, and some of them may have shone on the plate during its preparation, and caused fog. If these are found, they must be stopped up, and your annoyance may be over.

If these be not the cause, next suspect the window, for though it may admit only yellow light, it may not be yellow enough. Yellow materials become bleached, and require renewing, especially yellow calico. To test your window—and it is very important that you be quite certain on this point—proceed as follows: collodionize a plate as usual, and immerse it in the bath; then cover up your yellow window entirely, or leave only the smallest possible chink, so that you can just see what to do. Take your plate out of the bath and put it in the dark slide. Now remove the covering from the yellow window, and draw up the shutter of the dark slide *half way*, to expose *one half of the plate*: keep the plate to the light of the window for, say, five minutes, then replace the shutter, close up the window as before, so as to exclude the yellow light, and proceed to develop your plate. Keep the developing solution on about the usual time that is required to produce a picture, for you will not be able to see what is going on; then wash and fix it. Now restore the light and examine the plate, and it must present one of the three following appearances:—Case A, the half exposed to the window is drab, and the half not exposed is quite clear and transparent; case B, it has a drab deposit—in other words, fog—all over it; case C, the plate is perfectly clear and transparent all over.

We shall examine each of these. Case A shows that the yellow window is at fault, for the half of the glass exposed to

it is fogged, but the other half is clear; therefore sufficient actinic light passes through to injure the plate. The yellow covering, if bleached, must be removed, or more coverings must be supplied, and a plate must be tried after each addition, until you have your window so yellow that a plate may be exposed five minutes without being fogged. Yellow glass sometimes allows light enough to pass through to fog the plate; such glass should be removed, and a better sample put in its place. I have seen a piece of yellow-brownish glass, though very dark in colour, that admitted actinic light almost as freely as white glass. This is rare, but in photography you try all things, and only hold fast to that which is good. The window, by letting through too much white light, being discovered to be the cause of your trouble, it must be covered with fresh calico, tammy, silk, paper, glass, or other yellow material; or it may be painted yellow; but in some manner the light must pass through a yellow screen in such a way that, while you are permitted to see your manipulations, your plate must remain without fog. You must have no rest till this is accomplished. This done, your fogging trouble is over, and you may proceed to work in comfort; for case A clearly showed the window was the cause of the fog.

It should be borne in mind, however, that the amount of protection that a yellow window gives to sensitive plates depends upon the quantity of light that falls upon the window. Plates may be fogged on a day of sunshine, and yet be perfect on a dull day. A yellow window with a western aspect may suit a morning light, and yet cause fog in the afternoon. When the window of the developing room is thus exposed to a variable light, it should be provided with an additional

movable yellow curtain, to be used when a stronger light than usual falls on the window.

If the cause of fogging has thus been satisfactorily traced and cured, it will form an excellent lesson. But as there are other causes of fogging than an imperfect yellow window, let us examine case B.

Case B, the plate darkens all over under the action of the developer, and you can distinguish no difference between the two halves: this shows that your window is quite right, and you must seek further for the cause. It must now lie between the bath, the collodion, and the developer. First, try the bath; test it with a strip of reddened litmus paper, and if it changes to blue the bath is alkaline, and an alkaline bath is a certain cause of fogging. Add acetic acid, drop by drop, testing between each addition, until blue litmus paper is *very* slightly reddened. Again try a plate; the fogging will probably not be quite gone, but much reduced: add a little more acid until it entirely disappears.

Suppose, however, that the reddened litmus paper did not change colour, then test with blue litmus, and if it turn *very* red, carefully neutralize with oxide of silver, or ammonia, until only a slight acidity remains; then resume your trial to see if you have expelled your enemy, for excess of acid, especially nitric, will cause fog. Should the test-papers show that the bath is neither very acid nor alkaline, the probability is that the error is in the developer or the collodion.

Make up, carefully, a fresh developing solution, being particular not to omit the full proportion of acetic acid. You may even increase the quantity of acid, for some samples are weak, and you may happen to have one: the developing

solution, unless it have its proper addition of acid, will always cause fog. If the new developing solution rid you of your difficulty, well and good; if not, you must suspect your collodion. Some collodions cause fog, therefore get some fresh, and let it have a little colour—a pale golden, for instance—for colourless collodions are more prone to fog than coloured ones. If you are not now relieved, you may assume that the nitrate bath is the defaulter, for it must be one of the three. Make up a new bath, and if you use good silver and clean water, you are almost certain to be out of your trouble.

In this way, by carefully and exhaustively examining one thing at a time, you will be certain to trace out the delinquent material. If you have decided that the nitrate bath, for instance, is the cause, then you have, if it be a new one, to find out whether the sample of nitrate of silver is pure, or whether the water is not the cause. The latter is frequently an unsuspected source of trouble. Again, if it be found that the developer is at fault, supposing it to be correctly mixed, each of its components may be suspected and examined in turn—the iron, the water, the acetic acid, and the alcohol. Some samples of methylated alcohol often cause great annoyance by impurity.

To return to our examination: supposing that we have not yet discovered the cause of our fog; the conditions of cases A or B not applying, let us examine the next.

Case C, the plate develops perfectly clean and transparent all over: this shows not only that the yellow window is all right, but that the chemicals are right also; in fact, that the origin of the fog must be external to the dark room; and as nothing else but diffused light can now be the cause,

we must seek to discover it. First, examine the dark slide well; in some unsuspected manner it may admit light to the plate.

If your dark slide be found to be perfect, next examine your camera carefully. You may test it in this manner: prepare a sensitive plate as usual, and place it in the camera as if you were going to take a picture; put the cap on the lens, draw up *half way only* the shutter of the dark slide, but do not uncover the lens. Let the plate remain thus for a full minute, then develop and fix the plate. The plate will either be one-half fogged, or it will be quite clear all over. If half be fogged, it shows that the camera admits light in some other manner than through the lens, and thus the fog is caused. To know where the light is admitted, remove the ground-glass; and, excluding all light with the focussing cloth, put your head into the camera (the lens being still covered), and you will see the light streaming in. You may examine the interior of your camera in another manner. Place the dark slide in its place, and draw up the shutter; remove the lens, and with the aid of the focussing cloth again examine the interior through the flange aperture. If any stray light be admitted, you will see it on the face of the plate. It is necessary, when thus examining the interior of a camera, to wait for a few minutes, to allow the eye to get accustomed to the darkness, or you may deceive yourself, and think there is no light, from your momentary inability to perceive it. The cracks, crevices, or holes being stopped up, your trouble is passed.

Should your plate, however, develop clear all over, it will show that the interior of the camera is perfect. Another cause of fog may arise from the lens itself. If a strong light fall on it, particularly sunshine, fog will certainly be pro-

duced. A screen or shade should be provided, so that no light fall on the lens except from the objects that are being delineated. Occasionally there is reflection from the sides of the lens tube, or the edges of the back lens. Dead-black varnish will be the remedy in these cases.

If you have not now traced out the difficulty, having run through your chemicals and apparatus, it most probably is caused by an error of manipulation, such as over-exposure, or a deviation from the proper mode of developing. It is scarcely probable, however, that you could pursue this inquiry without already having a clue to the real cause; and I have gone through the series of exhaustive experiments to show you that, by this method of inquiry, you may succeed in tracing any trouble to its true source.

Transparent spots.—Causes: collodion not settled; bath requires filtering; dust in the camera; knocking dark slide when plate is in; bath not saturated with iodide of silver, or supersaturated with iodide of silver.

Opaque spots.—Causes: developer not filtered; dust falling on the plate while being coated; dirt, and dried fragments of collodion from lip of collodion bottle; dust and dirt from dark slide.

Streaky lines in the direction of the dip.—These are caused, in a new bath, by a deficiency of acid; in an old one, by the accumulation of ether and alcohol. Remedy: in the first, add acid cautiously till the streaks disappear; in the second, mix with it an equal bulk of 35-grain solution of nitrate of silver, or, better still, make up a new bath.

Sharp horizontal lines across the plate.—These are caused by hesitation in dipping the plate into the bath.

Collodion film mottled and thick.—The collodion requires diluting with a little plain ether.

The collodion film, on drying, peels off the glass; it is full of honeycomb-like markings; the film has transparent, crapy, diagonal lines, especially where the deposit is greatest.—These defects all arise from inferior collodion; procure some of better quality.

Opaque white marks and streaks at the end of the plate where the collodion was poured off.—Keep the plate a longer time before you immerse it in the bath; if this does not prevent the markings, add a little plain *un-iodized* collodion.

Transparent insensitive mark at the opposite end to where the collodion was poured off.—The plate was kept too long out of the bath, and the upper part has become dry; the plate must be immersed sooner into the bath.

Markings like curtains and fringes.—When these do not occur from bad manipulation—and be careful not too hastily to decide—these faults may arise from the collodion or the bath, and the best remedy is to endeavour to obtain samples that will work without thus plaguing you. When a strong iron developer is used, it is important that you have the proper quantity of alcohol in it, as this causes the solution to flow easily and smoothly all over the plate, and allows the developing solution readily to combine with the silver solution which is on the film. When the developer flows in irregular greasy lines, there are sure to be abundance of stains from this cause alone.

Defects in Glass Positives.

The light parts are pale and misty, and what should be the dark parts are drab-coloured.—Over-exposure produces this effect; reduce the time in the camera, or place a smaller diaphragm in the lens, to cause it to work slower. If this

treatment does not remove the mistiness, it may be produced by some of the causes of "fog," the remedies for which have been previously stated.

The blacks are very deep and brilliant, but deficient of detail, and the lights rather dark.—The exposure in camera is not sufficient, or the developing solution was poured off too soon.

The picture, after washing off the cyanide solution, has blue stains.—The developing solution has not been sufficiently washed away before the fixing solution was used.

The shadows of the picture are clear, but the light parts are chalky, and deficient in half-tone.—The developing solution has been kept on too long.

The picture is brilliant when wet, but on drying becomes dull, the shadows being misty blue instead of bright black.—Bad collodion is the cause of this defect.

Defects in Negatives.

The picture very intense where the light has acted most, and nearly transparent in the shadows.—The plate is under-exposed and over-developed.

The shadows have nearly as dense a deposit as the high lights.—The plate is over-exposed.

The image will not intensity under the action of the pyro-gallic acid and silver solution.—There are many causes for this defect, and you must discriminate which is the most probable in your own case, and act accordingly. Bad collodion —inferior nitrate of silver—too much acid, especially nitric, in your nitrate bath—the exposure, too long or too short in the camera—the absence of sufficient nitrate of silver solution

on the film or in the developing solution—cold and dark weather—deficiency of light—too small a stop used with long focus single lens.

The film floats off, or breaks away from the glass, during development or subsequent washing.—Defect in the collodion, or carelessness in manipulation; too much acid in the nitrate bath; plate immersed in bath too soon, or kept out too long; the edges of glass not sufficiently roughened.

The formation of crystals under the film when dry.—The hyposulphite solution not washed away enough. Sometimes this will show immediately; at other times it may be days or weeks before being seen.

Irregular smears and stains.—Dirty glasses are the most usual cause; also lifting the plate out of the nitrate bath too soon; placing it in the dark slide before the greasy lines have disappeared; not draining sufficiently, and the solution accumulating at the bottom; from dirty and wet plate-holders in the dark slide; handling the plate with dirty hands; the developing solution not flowing uniformly; pouring the developer principally on one spot; plate immersed in bath too soon, or not soon enough; developing glass not clean.

Defects in Paper Prints.

The paper does not print equally all over; has marbled or mottled spots.—The silver solution is too weak, or the paper has not been floated a sufficient time. If the *silver-meter* be used, and the strength kept up to at least 60 grains, this defect will never occur.

The print when finished has a disagreeable yellow tint, and on looking through, yellowish-brown opaque patches are seen.—

The print is not fixed; the hyposulphite is too weak, or has been in use too long, or the print has not been immersed long enough to dissolve the chloride of silver.

The whites and blacks are very brilliant, but a deficiency of detail in both.—The negative is at fault, under-exposed.

The prints are weak, cold, and slaty.—Under-printing and over-toning are the general causes. The hyposulphite solution may be too strong. Over-exposed negatives produce weak prints, deficient in proper contrast.

The prints are grey and mealy.—Over-toning and defective paper.

Red spots, streaks, and markings.—Defects in the paper, or the albumenizing, or both.

Prints will not readily tone, but remain of a brown, leathery hue.—Toning bath too alkaline; chloride of gold deficient in strength; the toning bath exhausted; the paper kept too long before being printed on, or, after being printed, kept too long before toning.

Metallic smears, spots, stains, finger marks, &c.—These defects nearly always arise from bad manipulation; handling the paper with dirty fingers; allowing solutions to splash; putting the paper on a dirty table; dust and dirt in the printing-frame, or on the pads used in the latter, or similar causes; or they may occur from bad paper.

THE proposed course of instruction in the usual collodion process is now completed, and practice is only required to make you entirely perfect.

Part II., you will find, is devoted particularly to the preparation of sensitive dry plates. These, however, you should not attempt until quite competent in the use of wet ones.

Part III. contains much that will be useful to you as you acquire experience, and is more addressed to the expert photographer than to the mere learner.

From the progress you may be presumed to have made, the homely and familiar style in which the instruction has been hitherto conveyed will now cease, and the remainder of the information will be given in a more condensed form.

Your attention is invited, however, to the following hints and general advice, by attention to which you will save much valuable time and materials, and render the practice of the Art more interesting and profitable.

HINTS AND GENERAL ADVICE.

CONCENTRATE your attention on the production of a good clean negative; a professional printer may be employed to produce your prints.

Never expect the faults of the negative to be corrected in the printing; a good print can never be produced from a bad negative.

Take a pride in cleaning the glasses well; stains and smears always indicate slovenliness and inattention.

Whenever you take a negative, take as good a one as you possibly can, even though it be a bad subject; almost anything looks well in a first-rate photograph; moreover it is excellent practice.

Never be contented with a medium picture if you can obtain a better one; "I dare say it will do!" will not do at all in good photography.

Obtain the most perfect apparatus that your means afford, and take a pride in keeping them clean and in good order.

Wipe your lenses, before using, with a soft chamois leather, and dust out the interior of your camera with a damp cloth.

Wipe your dark slide dry after each plate; the accumulation of nitrate of silver at the bottom corners of the dark slide stains the plate, rots the wood, and denotes the careless operator.

Carry your dark slide in a cloth when taking it from place to place (especially out of doors), and cover the top of the slide with it while the plate is being exposed.

Keep your camera exactly level when perpendicular objects are to be represented.

Get all parts of the picture into focus if you can; if not, make the principal objects the sharpest—in a portrait, the eye; in a group, the central figures; in a landscape, the foreground, in preference to distant objects.

Keep your nitrate bath always covered, and your bottles well corked or stoppered, as well as distinctly labelled.

Wash your hands after taking one picture, before commencing another.

Wash your developing-glass after each time of using.

Keep a separate vessel for every solution, and a separate bottle and funnel for each distinct purpose. Much time and trouble in cleaning dishes and bottles will be saved, and no end of uncertainty removed.

Never open a bottle of collodion, ether, alcohol, or varnish near a flame, or an explosion may take place.

Never allow the sun to shine on the lens when taking a picture.

Never attempt landscapes on windy or misty days.

Of the two errors, under-exposure is worse than over-exposure.

Aim at good pictures rather than quick ones.

There is more certainty in working a slow than a quick process.

Learn one process thoroughly, so as to be able to depend on it; then, and not till then, amuse and instruct yourself by practising others.

Don't be led away by every fresh idea you hear; don't expect to succeed with every new process you read of, but don't condemn it because it fails in your hands.

Don't believe every novelty to be an improvement; don't hastily credit every new discovery; make great allowance for the exaggeration and enthusiasm of inventors, but keep your mind open and unprejudiced, to receive every new truth, from whatever quarter it may proceed, or in whatever guise it may appear.

PART II.

ON PREPARING DRY COLLODION PLATES.

THE instruction previously given refers to the use of the collodion plate in its wet state. Experience has suggested many circumstances where it is inconvenient, or even impossible, to work the process, in consequence of the necessary attendant apparatus. Yet the desirability of obtaining photographs remains the same. Various means have been devised to use the plates *dry*, so that, being prepared before starting, they may be exposed during a journey away from home, and developed and finished on the return. This method of using sensitive plates naturally increases the usefulness of photography, but the knowledge how to prepare a wet plate is not sufficient to use it when dry. If the usual wet sensitive plate be allowed to dry, without taking any precautions, it will be found to be quite incapable of taking a photographic picture. It has to pass through another process, more or less complex, to enable it to be so used. It will be unnecessary here to detail the many methods that have been devised to so prepare the plate. It will be sufficient to describe a few of the most perfect plans.

Essentially, all the processes are the same: they all start by coating a plate with collodion, and sensitizing it in a nitrate of silver bath; their differences consist in the various methods employed to preserve the sensitiveness that the plate has attained. In most, if not in all, this sensitiveness is materially impaired; but, as the subject becomes better

understood, it will probably be found that the plate in its dried state is as susceptible to the influence of light as when wet.

Hitherto a sensitive dry plate has been treated as a wet plate *minus the water*, and by restoring the water the plate has been expected to return to the condition of an ordinary wet plate. Experience, however, has not quite confirmed this reasonable supposition. A re-wetted sensitive plate, even when re-immersed in the nitrate bath, does not return to the condition of an undried plate, and the mode of development so exactly adapted to the wet plate is not so well suited to the dry one when re-wetted. The conditions have changed, and the mode of development may alter too. Already the greatest advance in dry-plate photography has been, not in the preparing, but in developing the plate. Let the idea be once recognized that the dry plate is not bound necessarily by the conditions of the wet, and the path of discovery is opened. Great success has already been obtained by working in this direction, and that future advances will be made is extremely probable.

GENERAL REMARKS ON THE VARIOUS DRY PROCESSES.

In working any of the dry processes the operator is called upon to exercise much judgment, and for this reason inexperienced persons should not attempt the dry plates before thoroughly understanding the wet ones. In addition to all the difficulties of the usual wet process, there are added those of the particular dry method adopted. Though the various processes are different—some as complex as others are simple—yet a few remarks may be made which are equally applicable to them all.

The collodion film, as already remarked, when once dried, changes its character; and when re-wetted, never returns to the previous porous, pappy condition. It becomes skinny and horny, and does not adhere well to the glass. In some processes a thin coating of an adhesive substance—as albumen, gelatine, or india-rubber—is first put upon the plate, to prevent the film slipping off when re-wetted, and during development. If it were not for the trouble, some precaution of this kind might be adopted in every case; and the operator should remember that whatever process be practised, the perfect adhesion of the collodion to the plate can be secured by using first a coating of gelatine 3 grains to the ounce of water, or of albumen, white of one egg to 10 ounces of water, or of the thinnest film of india-rubber dissolved in chloroform, benzole, or turpentine.

Another method is to varnish the plate about a quarter of an inch all round before coating it with collodion.

Another plan is to varnish the sensitive film a quarter of an inch all round before re-wetting the plate.

An excellent suggestion by Mr. Bartholomew is, to pour common alcohol over the plate prior to developing; this seems to restore, to some extent, the porous condition. When the alcohol has well soaked in, the plate has to be washed, and the developer applied as usual; all the subsequent operations will be made better through this preliminary wash of alcohol, the plate behaving more like an ordinary wet one, and the film adhering better to the glass. The method is applicable to all processes, but is most useful to the simply washed plates and the tannin plates.

The nature of the collodion is of vital consequence in some processes, and of less moment in others. In those where

albumen forms an integral part, it is not so important; but in the simply washed plate, and with all varieties of the tannin plates, success is largely dependent on the collodion.

It will be seen, in glancing over different processes, that though the final end, a sensitive dry plate, is the thing aimed at in all, the means adopted to secure it are very varied. In nearly every case a something is incorporated with the sensitive film which is not present, or even needed, when the plate is used wet. The employment of the simply washed and then dried plate is, though the easiest, perhaps the least certain of all: yet persons do use the process with success. Nearly all experimenters find that by adding a final wash of some substance, the image develops and intensifies more like a wet plate than without this addition. The number of these preservative substances is endless, and the mode of employment constitutes the different dry processes. No end of aqueous solutions of animal and vegetable substances have been used, with different degrees of success. Albumen is deservedly a great favourite. Gelatine has been applied in more than one form, and sugar in many—to wit, honey, treacle, grape sugar, brown and white sugar, candy, and caramel; many syrups, especially raspberry; different gums; solutions of malt, beer, and ale; various wines, British and foreign; liquors and spirits; milk, tea, coffee, starch, dextrine, and kindred substances; in fact, there scarcely seems a limit to materials capable of being used for the purpose, so that the question is quickly obtruded, which is the best? To this there is no definite answer, for good pictures have been taken by every process. For absolute certainty, the Collodio-albumen, in its primitive form, is recommended; for simplicity, the "Washed-plate;" while the Tannin, and Dr. Ryley's Modified Fothergill Processes, are

both of them easy and certain, requiring little else than a knowledge of the wet process.

The collodion most suitable for all the processes is the bromo-iodized. It should be of the powdery, or non-contractile kind, and such that attaches itself tenaciously to the glass. In all instances the glasses require more careful cleaning than in the wet process, and if they be roughened about a quarter of an inch all round, it will be better than being plain, as the collodion attaches itself more firmly to roughened surfaces, and is less subject to detach itself when re-wetted.

THE SIMPLY "WASHED-PLATE" PROCESS.

This is the simplest process of all, and consists in preparing and sensitizing the plate as for the wet method, then washing it well in distilled water, to get rid of all the superficial nitrate of silver solution. The plate is then to be carefully dried in the dark. The exposure should not be much more than for a wet plate. Prior to development the plate must be re-immersed in the nitrate bath, and the development conducted just the same as for a wet plate, the ordinary developing solution being used. These plates will not keep. They should be prepared over night, and used the next day, and developed in as few hours as possible after exposure.

With favourable samples of collodion, this process yields good pictures.

THE TANNIN PROCESS.*

The Tannin process was first described in the sixth edition of "Hardwich's Photographic Chemistry." Its merits were quickly discovered, and it soon came into general use. Like

* This article is condensed from a paper read by the author before the London Photographic Society.

every process that has had general recognition, there has been a desire to improve it; hence a variety of modifications, alterations, additions, and variations of the original formula. These have often consisted in adding some other substances to the tannin, to improve its original goodness. With this view, honey, malt, glycerine, albumen, gum, sugar, gallic acid, pyrogallic acid, and many other substances have been proposed. Without calling in question the propriety of these additions, attention is called to the merits of the original process in its primitive form.

The process is satisfactory for its simplicity and certainty; it has also another recommendation, namely, that, except the solutions of tannin and carbonate of ammonia—both of which are easily made, and will keep any time—there are no chemicals required but such as are necessary for the ordinary wet collodion.

The collodion employed has been such as is fitted for ordinary negative portraits; that containing 4 grains of an iodide to 1 grain of a bromide has answered well. Any good commercial bromo-iodized collodion will answer, provided it works well in the wet process, and gives a dense creamy film. I confess to a partiality for creamy films; in the wet as well as the dry process, I think they are exempt from many of the evils to which more transparent films are prone.

I have not found it necessary to use any coating of gelatine or india-rubber to my plates before collodionizing, as the films have remained intact during all the necessary washings. I simply coat my plate in the usual manner, using a pneumatic holder, and allowing the collodion to flow to all the corners. When the film is set, the plate is immersed in the usual 30 or 35-grain nitrate of silver bath, such as is prepared

for taking portrait negatives. The bath is faintly acid. I have prepared plates in a bath containing as much as one drop of strong nitric acid to each ounce of solution; and, though I did not gain the advantage I sought in the experiment, I am not aware that the plates prepared in the bath were any the worse for the extra quantity of acid: from this I conclude that a considerable quantity of acid may be present in the bath without being prejudicial to the dry plate.

The plate is allowed to remain the usual time in the bath; when sensitized, and all apparent greasiness removed, it is taken and immersed in a dipping bath of distilled water. In this it is allowed to remain until another plate is sensitized, then washed for about sixty seconds under the tap, next flowed over with a 15-grain solution of tannin, and in this state set aside to dry.

These operations, thus easily described, are almost as easily performed; yet a few words in explanation will be in place. If, instead of putting the plate in distilled water when it comes from the bath, it be washed direct under the tap, it will certainly not turn out satisfactory, as there will be an irregular formation of chloride and carbonate of silver in and on the film. Immersion in a dish of common water will not be much better; but by first soaking the plate in distilled water, the greater part of the nitrate of silver is dissolved out, and the remaining washing can be done by common water. It is well to change the distilled water from time to time; how often, depends on the size and number of the plates, as well as on the quantity of distilled water employed. In sensitizing my usual size plates, 10 by 10, I change the water, about eighty ounces, for every six plates.

I have said, wash the plates for sixty seconds under the tap

after coming from the distilled water. You may say, why sixty seconds? and why not longer?

Well, I do not find any advantage in prolonged or excessive washing, but often a disadvantage; it is sufficient if the plate is washed enough. If the plate is insufficiently washed, when the tannin solution is poured on the film will turn brown. The first place where this *browning* takes place is at the thickened edge of the film, where the collodion was poured off. This is the place to look to judge of the sufficiency of the washing; if this portion of the film keeps its pure colour, it is washed enough; if it turns brown, more washing is necessary, and very probably the distilled water requires changing. If this browning is confined only to the thickened film on the edge, the plate may be safely used; but not so if the colour has extended over the film.

I have named a 15-grain solution of tannin: other degrees of strength may at times be desirable; but having succeeded so well with this strength, I have thought it good to adhere to it for general use. The strength of the solution of tannin, however, materially alters the character of the picture. As little as two grains per ounce of water may be used, and as much as sixty grains. The stronger the solution the greater contrast, and the more brilliant the negative will be; and the weaker the solution, the more soft.

When a subject has to be taken that is very feebly lighted and with little contrast, then a strong tannin solution will be useful to produce brilliancy. When violent contrasts exist—an interior of a church with very white columns and very deep shadows—then a two-grain solution will yield a more harmonious picture.

I have found samples of tannin differ, not only in solubility,

but in other qualities; I therefore suggest, when things do not work well, to try a different sample of tannin. It is important that the tannin solution should soak well into the film, so that all parts are equally imbued with it; unless this is done there will be marks and stains in the negative. I have generally held the plate with a pneumatic holder, and poured on the solution, allowing the first portion to flow off, carrying with it the surface water; a second portion has then been poured on, which I have allowed to flow backwards and forwards until it is thoroughly incorporated with the film. More recently I have adopted the plan of immersing the plate in a dish containing the solution of tannin, and allowing it to remain soaking until the next plate was ready. By this means all risks of stains and draining-marks are avoided. I think the tannin solution may be used indefinitely by occasionally strengthening and filtering it.

I have tried washing off the tannin before drying the plate, but have not been so well satisfied with the nature of the image. I have therefore returned to the original instructions of allowing the tannin to dry on the plate.

I have not used artificial means for drying. The plates are prepared in the dark room in the evening, and, resting on folds of blotting-paper, either in the rack or against the wall, remain unmolested till the morning, when they are found to be dry. The edges are then varnished, about an eighth of an inch all round, with the common asphalt black varnish used for glass positives, which answers remarkably well.

The plate is now ready for exposure; and to the natural question that may arise, "How long will it keep?" I can only give the innocent answer, "I don't know."

I have ordinarily used the plates soon after being prepared

(say within a week or ten days), and the longest time I have kept them has been about six weeks; to that time they were quite perfect, and I know no reason why they should not keep much longer.

I have no doubt that zinc or mahogany is the best to keep them in; but I have used only the regular deal plate-boxes.

With respect to the time required for exposure in the camera, I am sorry I cannot say, as some have done, "Give the same as for wet plates." I have tried them many times against wet collodion, and with alkaline development; they have required twice the exposure of the wet plates developed with iron; if developed with acid pyro, they required six times the amount of exposure. I always have in view the kind of development I intend to use when I expose; and I like to give as long as I can to each subject, knowing that while over-exposure may be modified, there is no remedy for under-exposure. When the conditions permit, I prefer to continue the exposure long enough to suit the acid pyro developer; but when I cannot do this, and quickness is essential, I then give as long as the subject will permit; I then use the alkaline pyro developer, and hope for the best. It is not always necessary that a person should work quick; there are many subjects to which you can give five minutes just as well as you can give one. When a picture is under-exposed, and we try to make it up by developing, I look on the developer as being over-taxed—as being called on to do not only its own work, but some part that light ought to have done too. No wonder, then, that the developer fails. I think it better to proportionally distribute the labour, allowing the light to do its full share. I think it lamentable to put the sun on short time, or the plate on short commons.

I sympathize strongly with a photographer when I see him struggling with an under-exposed plate, pouring his developer off and on, anxiously staring into the deep shadows for the detail that won't come, and dreading the fog that generally does.

I employ Dallmeyer triplet lenses for my out-door work, using as small stops as circumstances will permit. The plates used are 10 by 8. The exposures have varied considerably; the average being about five minutes, using a No. 2 triple and a medium stop. Where circumstances will allow, I think it good to use two plates to each view: not only are you more sure of having at least one good plate, but, by taking advantage of the different nature of the two developers, an error of exposure may be corrected in developing the second plate. There are two methods of developing these plates,—the alkaline and the acid. The alkaline is best suited to a short exposure, and the acid to a lengthened one. Each will be alluded to in turn.

As the plates develop quickly, any convenient method may be used to hold them. They may be held in the hand, placed on a levelling-stand, or a pneumatic holder with a handle may be used. This latter is my method. Wet the plate well, so as to moisten the film; and if the plate has received the minimum of exposure, proceed to develop it by the alkaline method. Make up a solution of

Carbonate of ammonia	...	40 grains
Distilled water	...	20 ounces.

Filter, and it is ready for use; and it will keep indefinitely. Pour sufficient over the wetted plate to amply cover; after flowing over, return the solution to the developing-glass, and

while there, add to each fluid ounce about as much dry pyrogallic acid as will lie on a shilling; it will dissolve immediately, and will not need filtering. Return the solution containing the dissolved pyro to the plate, and the image will quickly reveal itself. Allow the developing to go on till the details are seen by *reflected light*; for, on looking through, scarcely anything will be visible: wash the plate well, and proceed to intensify. This is done in the usual manner, with the acid solution of pyrogallic, to which is added, at the time of using, a few drops of (say) a 10-grain solution of nitrate of silver.

The following are serviceable solutions for use:—

Pyrogallic acid	2 grains
Citric acid	1 grain
Distilled water	1 ounce;
or,	
Pyrogallic acid	1 grain
Glacial acetic acid	½ drachm
Distilled water	1 ounce.

After the alkaline pyro has been well washed away, pour over the plate sufficient of the acid pyro solution to cover it: do this before adding the silver to it. The alkali that may remain in the film will thus be neutralized; return the solution to the developing-glass, add a few drops of the silver solution, and proceed with the intensifying. The previously weak image will quickly change into a strong and vigorous one. It is advisable not to make the image too dense in this stage, but to defer some portion of the intensifying till after the fixing in the hyposulphite. The fixing and successive washing completed, the plate had better be examined, and the little additional intensity required given in diffused white light. I

attach importance to this recommendation, as a great deal of the actinic density of these dry plates depends not so much on the quantity of the deposit as on the colour, and this cannot be definitely known till the plate is fixed.

If the plate has had what we may term the normal, or lengthened exposure, it may be developed by the acid method. It then requires only to be well wetted, and either of the above acid solutions of pyro, to which, at the time of using, a few drops of the silver solution are added, to be flowed over the plate, and the development will proceed almost as quickly as in a wet plate.

When developing by the acid method, it is desirable, in the first instance, to bring out the image with the least quantity of silver solution. The development can then be prolonged till all the deepest details are out, without the highest lights becoming too intense. When the image is thus all developed, then is the time to add more silver and proceed with the intensifying, never, however, continuing it to the full extent, but leaving the final touches to be given after fixing. If the picture appear over-exposed, the greater part of the intensifying should be done after fixing; but if under-exposed, then as much intensity as can safely be given should be done before fixing, because intensifying after has a tendency to increase the contrasts in the picture.

The negative, thus duly intensified, has only to be dried and varnished, and it is ready for printing.

These negatives have always a more or less veiled or slightly foggy appearance; this is only seen by looking at them; on looking through, the shadows are quite pure and transparent.

I look on the development as being by far the most

important part of the process, and the one in which there is the greatest scope for the exercise of judgment. It was the reproach of the tannin process in its early days that all the pictures were of wiry hardness. My experience shows that there is no necessary reason why the pictures should be hard. If the exposure be sufficient, it is all a question of development. The first object is to get out *all* the picture in the deepest shades before any strong density is produced in the high lights. This done, the intensifying can be calmly proceeded with; when, as in the old-fashioned way, the developing and intensifying were conducted simultaneously, there was always a danger of making the high lights too intense before the details were brought out in the shades. If, however, only the weak image be first produced, then the manipulator has it quite under control whether he shall produce a soft or a hard picture; for, if the exposure be enough, all weak pictures are soft pictures, and it is only when they are made too intense that they become hard. The exercise of judgment is required to know how far to go so as to secure vigour without losing softness. When using the alkaline developer, there is no fear of the first or purely developing stage being carried too far; for the developer, no matter how long you keep it on, in reason, will only make a weak, thin image; it is in developing with acid, pyro, and silver the error may be made. If, however, only a very little silver be added to the developer, and patience be used, almost as weak an image may be produced by acid pyro and silver as by carbonate of ammonia and pyro. A well-developed weak image being obtained by either means, all the elements of a soft yet brilliant picture are secured, the rest being the exercise of skill in intensifying.

By attention to these points hard pictures may be avoided, and soft ones secured, not only by the tannin, but, I believe, by every other dry process.

A few words may here be said as to the merits of acid and alkaline development. I consider alkaline development to be a very valuable discovery, enabling us to bring out an image with certainly less than one-half the exposure otherwise required. This materially increases the usefulness of dry plates, and opens out untrodden paths of photographic discovery. The images produced by this means seem every bit as perfect as by the acid method; in fact, when the plates are done, I cannot tell the one from the other. I use the two plans according to requirements; for, while distinctly recognizing the value of the alkaline developer, I by no means pin my faith to its exclusive use. Where the circumstances are favourable, I still adapt my exposure to suit the acid method, as being the safer of the two. If I expose my plate for alkaline development, and I give too little time, I have lost my picture, for the acid method will render me no assistance; but if I over-expose, then the acid method naturally comes to my assistance. In like manner, if I expose for acid development, and give too little time, the alkaline developer will be my friend. By this means I have two strings to my bow.

On the whole, then, I look upon this discovery as a reserve of force—a something wonderfully useful to have recourse to when the usual means are quite inadequate; and as its usefulness is by no means confined to this process, I strongly recommend all dry-plate workers to add this new force to their powers.

I have already spoken of the image produced by alkaline

pyro as being extremely thin and weak; it has been aptly termed a *phantom* image. Sometimes, with very short exposure, only the general outlines of a picture make their appearance. I have then found it advisable to increase the power by adding more dry pyrogallic acid to the developing solution. In rare cases I have used as much as ten grains of pyro to one ounce of the carbonate-of-ammonia solution, and have thus extracted a latent image that otherwise would not come forth. This, however, is a potent photographic spell for bringing spirits from the vasty deep, that can only be recommended in exceptional cases, as there is always a much greater chance of raising the spirit of darkness, Fog, than the image we desire.

I have not found any advantage in increasing the strength of the carbonate of ammonia above two grains per ounce. Carbonate of soda has never succeeded so well with me as the ammonia-salt.

The virtues of hot solutions have been duly recorded for bringing out images with very short exposures; and, theoretically, a hot solution of alkaline pyro ought to be a most powerful developer. I cannot compliment myself, however, on my few essays in that direction; the results were rather humiliating than otherwise. Referring to these extreme and daring methods of development, I am reminded of an anecdote of three men, who applied for a vacant coachmanship. A test-question was put to each, how near he could go to the edge of the road without going over. The first said he could go with perfect safety to within an inch; the second could go to a hair's-breadth; but the third said he always kept as far as he could from the edge, and preferred to drive down the middle of the road. When I have been pushing the development

in some refractory plate, that has had scarcely a gleam of light, hunting up the latent image that declined to put in an appearance, dosing it with fresh and more powerful stimulants, pitching it in hot and strong, defying fog, and treading on the very brink of destruction; under these circumstances, I have thought that, after all, it would be safer "to drive down the middle of the road."

The appearance of the plate after exposure will sometimes suggest the best mode of development. If the image be visible on the plate when it comes from the dark slide—which it sometimes is—it has certainly been sufficiently exposed, so as not to need alkaline pyro. Sometimes on wetting the plate only, the image will spring forth; in such case also the alkaline pyro will not be needed. Also when the image comes out on the application of the carbonate of ammonia solution, before the pyro is added, the plate may be well washed, and the remainder of the development entrusted to the acid pyro and silver. In this latter case the acid pyro must first be flowed over the plate to neutralize any ammonia-salt in the film before the silver is added. If this precaution be omitted in this and analogous cases, there will be a certain fogging produced.

In the absence of any of the appearances named, the judgment must be used as to which developer to employ. It is sufficient to say, that it is always safer to use the alkaline than the acid pyro where there is a doubt, as, although a plate with abundance of exposure will always make a better negative if developed with acid pyro, yet, be the exposure ever so great, a picture can with care always be made from the alkaline-developed image.

I have only now to close by briefly summarising what I

have so circuitously stated. In short, then, I prepare my plate by cleaning the glass, coating it with collodion, sensitizing it with the silver bath, exactly the same as for taking wet negatives by iron development; the sensitized plate, when taken from the nitrate bath, is put into a bath of distilled water, instead of being put into the dark slide; it remains in this water till another plate is sensitized; then it is washed for about a minute under the tap, and a 15-grain solution of tannin is flowed over, and it is allowed to dry in darkness. When dry, the edges are varnished with black varnish, and the plate is ready for use. It will keep for certainty, a month or two. If the exposure be sufficient, the development will be quite easy with the old-fashioned pyro developer and a few drops of silver solution. If the exposure is short, the development must be commenced with carbonate of ammonia and pyro, and finished with pyro and silver; and —this constitutes the whole process.

DR. RYLEY'S FOTHERGILL PROCESS.

The plate has to be sensitized as usual, and thoroughly well washed. Coat the plate with the following solution of albumen :—

Albumen	1 ounce
Water	2 ounces
Ammonia	30 minims.

Beat well up to a froth, allow it to settle, and filter before use. Pour sufficient of this over the plate to cover it; let it flow backwards and forwards to soak into the film. Pour the albumenous solution away, and thoroughly wash the plate, the last rinsing being with distilled water. Let the plate dry.

When perfectly dry, moisten the plate with distilled water, and pour over the following solution :—

Tannin	...	...	...	1 grain
Gallic acid	...	...	...	1 „
Water	...	...	...	1 ounce.

Filter the solution before using. Pour it on and off the plate to well permeate the film, then set the plate up to drain, and dry, without washing off this tannin and gallic acid solution. When surface-dry, finish by the heat of a dull fire.

These plates retain their sensitiveness well: Mr. Morley, of Islington, once showed me a negative that had been sensitized six months before exposure, and it was as perfect as plates newly prepared. The development of the plates may be by the acid or alkaline method, as for the tannin process, the same directions and manipulations being equally applicable.

The peculiarity of this process consists in the final wash of gallic acid and tannin *after the prepared plate has dried from its albumenous coating.*

An interesting experiment was tried by Mr. Morley to test the utility of this final wash of gallic acid. On one occasion, having some plates prepared without the gallic acid and tannin, but which, on examination prior to exposure, looked very unsatisfactory, having stains and markings of an annoying character very plainly evident, he determined to test the usefulness of the gallic acid. Upon a particular plate he poured, but on one-half only, a solution of gallic acid. The plate was dried, exposed, and developed as usual, and on the half without gallic acid the image was poor, weak, and dirty; while the other side was brilliant, clean, stainless, and all that was to be desired.

This method is, therefore, strongly recommended to the attention of amateurs, as well as the profession, as a certain means of producing a dry plate that may really be depended on.

In developing these plates, care must be taken not to make them too intense, as they become of such a strong non-actinic colour that very little density is required, or the pictures will be hard and wiry.

THE COLLODIO-ALBUMEN PROCESS.

This process is not only one of the oldest, but also one of the safest and most reliable of the dry processes. It is sometimes called the "Taupenot" process, in compliment to the inventor. It is in reality a double process, in which sensitized collodion and albumen each play an important part in the production of the negative. Being thus duplicated, the manipulations are more numerous than in other methods. This is probably the reason the process is less popular than the simpler ones. But its peculiarity is, that the collodion and the albumen seem to unite and support each other, and, unitedly, to do something better than they often effect separately. The process is usually described as "slow, but sure;" but with the aid of heat, and the absence of acid (or even with the presence of alkali) in the developer, it is probable that by this process as rapid pictures may be taken as by any other. It is, however, certain that by its means Mr. Mudd, of Manchester, and others, have produced some of the most lovely photographs that have ever been taken.

The collodion employed is the ordinary bromo-iodized; it should be of the kind that adheres tenaciously to the glass. Pour it on as usual, and let i set well before immersing in the nitrate bath. A pneumatic holder should be used, so

that the plate may be covered to all the corners. Next immerse it in the silver bath.

NITRATE OF SILVER BATH.

Re-crystallized nitrate of silver ...	1	ounce
Distilled or boiled rain-water ...	12	ounces
Glacial acetic acid	½	ounce.
Iodide of potassium	2	grains.

Dissolve, filter, and the bath is ready for use.

When the plate is sensitized, wash it well with common water, and place it in a dish half filled with solution of iodide of potassium, three grains to the ounce, and allow it to remain while the next plate is being prepared. Then remove it from this solution, and wash it well with clean water, and pour over its surface the following solution of iodized albumen:—

IODIZED ALBUMEN SOLUTION.

Distilled water	2½	ounces
White of eggs	10	„
Iodide of potassium	50	grains
Bromide of ammonium	10	„
Liquor ammonia (fortis) ...	120	minims.

Place these materials, together with some pieces of broken glass, in a bottle capable of holding twice the quantity, and agitate till the whole forms a froth, and then, when settled, it is ready. This solution will keep a considerable time, but must be filtered before using.

Allow the solution to flow backwards and forwards, to well saturate the film; repeat this operation with a second portion, and then set the plate aside to drain on blotting-paper. When the moisture is principally removed, finish the drying before a fire, or by other convenient means.

The plate, in this condition, is nearly insensitive to light, and, provided it be kept dry, will remain good for any time.

To render it sensitive, heat it as hot as the hand will bear, and, when cool, immerse it again in the aceto-nitrate of silver bath for one minute, *using only a yellow light*, then wash thoroughly in clean water, and dry in the dark.

ACETO-NITRATE BATH.

Nitrate of silver	30 grains
Distilled water	1 ounce
Glacial acetic acid	½ drachm.

When this bath becomes discoloured—which it will, by sensitizing the albumenized plates—it should be poured into a bottle containing a couple of ounces of kaolin, and, when well shaken, allowed to rest for some hours. This will remove the colour. The kaolin may be kept in the bottle for future use.

These sensitive plates will keep good for a few weeks in warm weather, or even months in cold, if the last washing has been perfect; yet it is better to use them as soon as convenient after their second sensitizing. They will require about six times as long exposure as ordinary wet collodion, but a little over or under is not very important; an error on the former side being better than the latter, the special point being to expose sufficiently long to bring out all the detail in the deepest shadows.

Gallic acid or pyrogallic may be used as developers. If the former, put the plate in a dish, and pour over sufficient saturated solution of gallic acid to cover it; and when the film has been wetted, add a few drops of a 30-grain nitrate of silver solution. The image will begin to make its appear-

ance in a few minutes. This developing solution does not act quickly, but it produces excellent results. From half an hour to an hour is the usual time required, sometimes much longer, if the plate has been under-exposed. Several plates may, however, be developing at the same time. They may be taken out and examined occasionally. If a sediment form on the surface, wash the plate, and, while under the water, use a little friction to remove it, employing a large camel-hair brush, cotton wool, or even the finger; then return the plate to the developing solution, and continue the action. It is surprising how hard the film is, and what an amount of rough usage these prepared plates will bear, compared with the usual collodion films. The development must be continued till all the details are entirely out, and the requisite density produced. It must be remembered that the deposit produced on these plates has a greater power of obstructing light than in the usual process; the same amount of density, therefore, is not required, or the finished picture will be too hard and chalky.

Developing with gallic acid is, perhaps, the best method for a beginner to adopt: its main objection is its tediousness. A quicker method is by using pyrogallic acid.

PYROGALLIC SOLUTION.

Pyrogallic acid	...	...	2 or 3 grains
Water	...	...	1 ounce.

Wet the plate well, and pour over the above solution. If the proper exposure has been given, the general outlines of the picture show directly: keep the pyro solution moving about till the details show themselves. In this stage the image is so weak and thin that it can only be judged by looking down

on it, not by looking through it. It is sufficient if the shadows are all brought out in the darker parts of the negative, as sufficient intensity will be obtained in the next operation.

The plate may now be washed and intensified. Make up a solution of—

Nitrate of silver	5 grains
Citric acid	10 grains
Water	1 ounce.

Add about a drachm of this to the plain pyro solution, and pour it on the plate. The image will quickly intensify and become dense in the usual manner.

The advantage of developing in the method stated, with plain pyro instead of at once using acid pyro, is that the developing and the intensifying processes are separated, and the operator has therefore more control over his picture from over- or under-exposure.

The whole method bears close analogy to the alkaline mode of developing tannin plates, reference to which is requested for more ample details of the method of intensifying the original phantom image.

Saturated solution of hypo must be used for fixing these plates, not cyanide of potassium.

For most interesting and lucid instruction in this process the reader is referred to Mr. Mudd's valuable *brochure*, entitled "Collodio-Albumen Process, and Other Papers." This book gives the fullest information on the process, and contains Mr. M.'s narration of his own *modus operandi* in the production of those charming pictures which have made his name so famous.

PART III.

ABOUT LIGHT, AND HOW TO USE IT.

The preceding portion of this Manual has been occupied with the description of the proper methods of producing sensitive wet and dry plates. The pupil, being supposed to be proficient, will now have to apply this knowledge to a practical end; he may attempt portraiture, still-life, landscapes, copying paintings, or the thousand and one other applications of the art, but he will speedily discover that the most important thing he has to learn is the management of his light. On the proper management of it depends the chief success of the photographer. This is the most difficult part of the art to teach, because no absolute rules or exact formulæ can be laid down. He will also have to learn, on this subject, that no reliance is to be placed on lens, camera, and chemicals. These, valuable enough in their places, can teach him nothing here. He must go to the fountain head—light itself. Whatever light falls on, it enlightens, whitens. White is the representative of light; black, that of darkness. If an object be wished to be represented white it must be placed in the light; if black, the light must be excluded from it; if partially white and partially black, the light must be allowed so to fall on it that, while the parts that are to be represented white must be illuminated, the others that are to be black must be protected from illumination.

These principles—almost too simple to be gravely stated—

contain all that is meant by "management of light." They apply universally to landscape, architecture, portraiture, and everything else. Before a photographer proceeds to take a picture he should settle in his own mind what sort of picture he intends it to be, and not wait until it "comes out" to see if it will "do." It is too late then. A man should definitely start with a fixed idea in his mind, and let his work carry it out. For instance, if he admire in portraits a broad, bold style, where the lights and shades are strongly marked, and the whole picture very brilliant, let him arrange his light so that the sitter has the light falling on him in that manner, and then aim, by camera and chemicals, to accurately copy his illuminated model. If a soft and delicate picture—where half-tone abounds—be preferred, let the light so fall as to show these half-tones on the face of the sitter. Then, as before, let mechanical photography do the rest. But the first and primary condition is not to expect, by any modification of mere photography, to produce the effects that are legitimately due to light. For example, if a sitter have the light and shade strongly shown on the face by the arrangement of the light, although an under-exposed or an over-intensified negative will exaggerate the same, yet an over-exposed or under-intensified one will not make a soft picture. In like manner, if a sitter be lighted very uniformly, though an under-exposed picture will increase the contrast, yet no management of chemicals will make it a brilliant one. The point wished to be insisted on is, that the effects due to arrangement of light should be considered quite distinctly from the effects of manipulation. A photographer can do much by both the one and the other; but he should not confound the two, or, still less, call on one to supply the shortcomings of the other.

If the idea be distinctly recognized, that as the light falls on an object so is it represented, the question of its "management" is very simple; for the lens may be regarded as an eye, and as capable of representing objects with the lights and shadows only as it sees them. The photographer can, therefore, by the use of his own eye judge of the effect that his lens will see, and he may take the photograph or not, according to the suitabiliy of the light. In out-door photography this is of the greatest consequence, for some views are best illuminated early in the morning, others late in the afternoon, and some only about midday.

In in-door work the photographer may be supposed to have the light under his control; then it is a question of placing his sitter or object nearer or farther from the window, as well as the arrangement of curtains and blinds.

The primary idea however is, before taking any photograph, to observe how the object is lighted, and to take this into consideration as of equal importance to the exposure the plate will receive, or the development that will follow. If the question of "lighting" be regarded in this true, yet simple manner, the photographer has the key to the whole subject, and all the rest depends on his taste in using his knowledge.

HOW TO CONSTRUCT A GOOD GLASS ROOM.

To have a well-constructed glass room is a matter of vital importance to a professional photographer. Such a room ought to permit the sitter to be properly and quickly lighted, so that good portraits can be taken with expedition. It should be adapted for working in dull weather as well as bright, and the sitter should be able to have either side of the face taken without turning the eyes to the light. The room should

be well ventilated, not too warm in summer, but sufficiently so in winter; and no fumes of chemicals should be present. Many of these desirable conditions will depend on the size and aspect of the room.

During the last few years glass rooms have been built in every variety of form; but after a fair trial, practical men are satisfied that an oblong room with a ridge roof is the very best. Local necessities will often dictate the size, shape, and aspect of a room; when, however, the photographer can have control, the writer believes that a room built as he is about to describe will be found to be the most perfect for a professional photographer that present knowledge can suggest. If circumstances permit, it should be built on the ground floor. It should be oblong in form, the length running from east to west, so that one of the long sides should have a clear north aspect. Its length should not be less than 25 feet, and need not be more than 40 feet. The width may be 16 feet, but must not be less than 10 feet. Although called a "glass" room, it should be built of substantial brickwork, except the side facing the north and half of the roof on the same side; these should be of glass. The south side of the roof should be slated, and the whole building should, if possible, on that side be built against a wall much higher than itself, so as to screen it from the sun at mid-day. Buildings, trees, or other objects should protect the ends from the morning and afternoon sunshine. Under these conditions the room will be lighted only from the north, and will have the most uniform and soft light that it is possible to obtain. Such a condition of light will be found by the professional to be the most perfect, in a commercial sense, that he can obtain. Undisturbed by sunshine, morning,

noon, and afternoon, his light will be so steady and uniform that he can produce his negatives with almost absolute certainty.

Suppose a medium of the sizes referred to be adopted—say 32 feet long by 12 feet wide—a handsome apartment will be formed, large enough to take a numerous group, and to contain the apparatus and furniture of a well-appointed studio. The sides, up to the eaves of the roof, should not be less than 8 feet, and need not be more than 10 feet; the height to the ridge should be in proportion, from 13 to 16 feet high. This will give a good slope to the roof, helping to keep the glass clean, and to prevent leakage, to which fault flatter roofs are very subject. The glass should not go to the ends of the room, but about 6 feet of each side should be bricked up, and the roof should be slated at each end about 6 feet also. If the room be 32 feet long, this will yield about 20 feet length of side and top light, all of which should have opaque blinds. As it is not advisable at any time to use more light than is necessary to illuminate the sitter, not more than half the light provided should be used at one time. A background should be placed at each end of the room, and at which ever end the sitter is placed, the blinds should be opened on that side only; the darkened portion of the room will be pleasant for the sitter to look into, and useful to place the camera in. When the sitter is taken at the other end, everything must be reversed. As the majority of portraits are best taken with three-quarter face—the light on the near side and the shadow on the retiring side of the face—and also as a more agreeable likeness and a pleasanter expression and definition of the eyes are secured when they are allowed to look away from the light, these desirable conditions are entirely secured by this

arrangement of light. The side of the room should be papered or painted of a rather light colour, but not white, and the reflection from this will, in nearly all cases, be sufficient to prevent dark shadows on the least illumined side of the face. A screen reflector may be used if thought desirable. Considerable varieties of effect may be caused by placing the sitter nearer or further from the window. By having a background at each end of the room, either side of the face may be taken equally well, and this is a point by no means to be undervalued by the portraitist.

Though by no means so necessary as the points alluded to, yet no glass room is complete without a perfect system of ventilation, so that the greatest amount of coolness in summer and warmth in winter may be obtained, and pure air always. A room constructed as here described will be much more healthy than the usual conservatory-like structures, which are cold in winter, hot in summer, leaky in wet weather, and dirty all the year round. Yet all rooms devoted to photography should be thoroughly ventilated, and the chief point in ventilation is to provide for the escape of the hot and vitiated air which rises to the top of the apartment. In the glass room, therefore, the very ridge is the place. Doors and side windows are well for letting in cold air, for which, by the bye, there is no room till the hot air escapes; but the heated atmosphere crowds to the top of the room, eager to go out in that direction, but objecting to go in any other. Provide it with proper means to go out, and the colder and purer air will always find a way to take its place. A good glass room should also be provided with means to heat it in wet and cold weather. If a hot water system cannot be used, a good household grate, giving a cheerful fire, may be provided

on the bricked-up side. Above all things, that deadly abomination, a gas-stove, should be avoided. By attending to these minor points, though they are not photographic essentials, the sitter will feel and look more pleasant during the ordeal, and the photographer himself will derive greater health and pleasure in following his business; thus these smaller matters will help to make a well-constructed glass room more useful and perfect.

ABOUT PRINTING AND TONING, AND HOW TO SECURE GOOD PRINTS.

Although general instructions respecting printing have been given in the earlier part of this work, yet the subject is so important that fuller details will be very useful.

It is scarcely possible to over-estimate the value of good printing. All the preceding operations are but preparatory steps to this one. A good print, one that it is a pleasure to look upon, is an adequate reward for much time and labour; and what is the use of all the skill and expense necessary in the production of a negative, if a good print is not ultimately to be yielded from it? Among photographers generally, the importance of good printing does not seem sufficiently impressed. No end of pains are very properly spent on the production of negatives, which are often placed in the hard, unfeeling hands of the printer; for the majority of printers are of a coarse and ignorant race. If the same feeling were used in the production of the prints, as is done in that of the negatives they are taken from, photographs would have a higher value than they now possess.

Good printing depends on many things. It is not merely

albumenized paper and nitrate of silver, chloride of gold and hypo; these are only the materials out of which good or bad prints are to be made, according to the ability of the printer. There are some conditions, however, that even the cleverest require before they can do good work, one of the most important being a good negative.

The kind of Negative necessary to give a good Print.—The first step towards obtaining a fine print is to get a good negative; this secured, it is surprising how many troubles are removed. It is difficult enough to procure good paper, and to keep the toning bath in order, without complicating these troubles with the poor and weak images produced from faulty negatives. If a person aims at producing strong and vigorous prints, he must make his negatives with plenty of contrast, or if he wish them to be full of delicate detail and half-tone, the negatives must have the same character. It is pitiable to see a man wasting his time and means in trying to produce rich black and white tones from weak, thin negatives, capable of yielding only brown or grey tones. Under such circumstances there is little use in changing the paper, or varying the toning—the fault lies in the negative, and there is no evading it. With a good negative almost any depth of tone may be produced by almost any process.

The Necessity of Good Paper.—The next most important step is to get good albumenized paper. This is not so easy a matter. To produce this article uniformly good seems hardly possible. No two samples of paper from the manufacturer seem ever to be the same, and the source of trouble is more often found there than in the albumenizing. The paper used to spread the layer of albumen upon is chiefly

foreign made. Paper made in this country does not suit the photographer so well as that made abroad.

Distinction between Saxe and Rive Papers.—France and Germany furnish nearly all the paper that is used, and each has its own peculiarities. Neither is a perfect paper. The principal French paper is known as *Rive*, from the place where it is made, and its peculiarities are more or less the same as those of all French papers. It may, therefore, be taken as the type. The German papers are usually described as *Saxe*; though they are made in all parts of Germany, yet the mode of manufacture is very generally the same. *Saxe paper*, therefore, represents that made by a particular method common to a large district, and is indicative of a certain character considerably different from the French or *Rive* paper.

Rive papers are much harder on their surface than *Saxe*, and the albumen sinks in less, giving, therefore, a more highly glazed face. This is very well adapted for cartes-de-visite and stereoscopics, but it is not so well suited for larger work, as the paper is apt to tear in the washing. Blisters are also more abundant; but the numerous holes and metal spots always found in this paper are its greatest objections. The film of albumen seems not to take so kindly to this as to the *Saxe* paper, hence there are more streaks and markings; yet, with all these drawbacks, this paper is a favourite, in consequence of its brilliancy. *Saxe* paper is much more uniform in its texture; it has scarcely any of the defects of the *Rive*, yet the albumen forms a duller surface, and the pictures seem more sunken into the paper. In practice it is much more economical to use, as there is less waste with streaks, markings, or metal spots. Some samples may be

obtained with a much higher glaze than others. The tones yielded by these two papers are rather different. The *Rive* yields warm browns and purples, the *Saxe* gives purple blacks.

Sensitizing Solution.—There is no absolute rule as to the strength of the silver solution for sensitizing, although, as most papers give good results with 60 grains to the ounce, that may be considered as a standard. Some samples, however, yield better prints on an 80 or 90-grain solution, and with others as low as 40 or 50 grains will do. Generally, three or four minutes' floating will be found sufficient. The colour of the print in the pressure-frame while printing is a good indication whether the silver solution is of the right strength. If it be of a foxy red, the silver is too weak or too acid; if a dark blue or bluish purple, it is too strong, or too alkaline. There is no advantage, but the contrary, in using the silver solution too strong, for the ultimate print is no better, and this bluish colour misleads in the toning, as it cannot be seen when it has been sufficiently acted upon in the toning bath. A paper that prints a red-purple shows that no excess of nitrate of silver is used, and this colour allows all the changes by the gold to be observed in the toning bath. The use of the silver meter is strongly recommended to prevent anything like guess-work as to the strength of the silver bath. It is best to sensitize the paper the same day as it is printed.

Printing, and Washing the Print before Toning.—It is impossible to give any rule how much deeper to print than the finished picture is wished to be, as some papers bleach more than others in the toning process. It is a singular fact, however, that this circumstance is modified by the nature of

the water used for the preliminary washings, rain or distilled water requiring very little over-printing. These preliminary washings are often too much hurried over; they should be carefully done, to get all the nitrate of silver out of the paper; and these washing waters should be saved, and the silver precipitated by common salt. The print, when well washed, is ready for toning.

Merits of various Toning Baths.—There are several formulæ published, each having its advocates, but one principle is common to them all; they all consist of a solution of chloride of gold, but differ from each other by having some other salt added to it.

It is best to keep the chloride of gold in a solution of known strength (say 15 grains in 15 drachms of water, then each drachm will contain a grain).

Of the three toning baths hereafter described, the "carbonate of soda" is the simplest; the "acetate of soda" is the best for all general purposes; and the "chloride of lime" the most peculiar.

Some subjects look best produced in one tone, and some in another; and the acetate bath allows a very great variety of tones, and all agreeable ones. It is no small merit that it will keep. The "chloride of lime" bath is a peculiar one; it has but a small scale of agreeable tones, and is thus far inferior to the other two. It is the only bath that gives a black tone. With good negatives, nice paper, careful printing, and hitting just the tone in the toning bath, excellent black and white pictures may be produced. It will be inferred from this that the bath requires great care to produce good results. Such is the case, and, in skilful hands, nothing is so fine for portraiture; but a large margin must be allowed

for failures, or, at least, for prints that are not up to the best standard.

CARBONATE OF SODA TONING BATH:

Chloride of gold	1 grain
Carbonate of soda	15 grains
Water	10 ounces.

Make the solution with hot water about one hour before using, and prepare only as much as will be used, as it does not keep well.

ACETATE OF SODA TONING BATH.

Chloride of gold	1 grain
Acetate of soda	20 grains
Carbonate of soda	20 ,,
Water	10 ounces.

Mix the carbonate of soda and gold first, and then add the acetate of soda. This toning solution should be made an hour or two before wanted, and after being once used will keep well.

CHLORIDE OF LIME TONING BATH.

No. 1.

Chloride of lime	½ ounce
Distilled water	16 ounces.

No. 2.

Chloride of gold	1 grain
Carbonate of lime (powdered chalk)	3 grains
Water	1 ounce.

Mix No. 1, agitate well, filter, and keep in a stoppered bottle. Into 8 ounces of very hot distilled water put No. 2; agitate

for five minutes, then add ½ ounce No. 1, and when cold the toning bath is ready for use. Hot water is employed to make the bath ready for immediate use. If cold water were taken, the bath must remain a week before being used. The bath will improve with working.

Instructions for Toning.—Whatever toning bath be used, print a little deeper than is needed; the depth varies with different papers, for some bleach more than others. It is impossible to give any special and exact directions for toning, because the conditions are always varying. The operator must keep a watchful eye to the changes of colour that take place, so as to take the print out just when it is enough toned. The prints must not be toned in broad daylight, nor in yellow light, for in the latter, the shade of colour would not be seen. A weak shaded white light is the best. When the toning bath is new and strong, but few prints should be kept in at a time, and they must all be kept constantly turned over and moved about, so that they do not lay over each other, or get air-bubbles between them, and thus get unequally toned. In cold weather, it is better for the toning solution to be used warm; it will then tone much quicker. A useful plan is to fill a dish with hot water, and let the vessel holding the toning solution stand in it. The progress of the toning can often be judged best by looking *through* the print. The colour given by the gold must not only be on the surface, but must be seen when looked at as a transparency. Unless it is toned thus far, it will probably lose all its rich colour in the hypo. Most prints thus lose somewhat of their tone, and allowance for it should therefore be made, by carrying the toning a little further; but how much further is a matter for experience to determine, according to all circumstances of the

moment. Some persons put a batch of prints in at a time, and when one is toned, they assume that all are toned, and take them all out. This is a wholesale mode, that rarely turns out well. The prints should be kept constantly moving and turned, to prevent unequal toning; and as each is turned over it should be glanced at, and when toned enough, it should be put in a separate dish of water, which should be ready at hand. Some prints tone much more readily than others; some require to be carried further, according to the subject. As some are taken out, fresh untoned ones can be put in, until all are toned. They can then, unless too large a batch, be all fixed at one operation. The dish of water, into which the prints are put to wait until they are fixed, should have some common salt put into it, the quantity not important, so that it has a distinct taste. Unless this precaution be taken, the prints will go on toning; for when they are lifted out of the bath they are saturated with toning solution. But this salt solution instantly arrests the toning action. The prints may safely be left here till all the toning is completed for the day. They are then ready for the final operation of fixing.

Fixing Solution.

Hyposulphite of soda	4 ounces
Water	1 quart.

This solution should be made fresh every time of using. The strength of this solution, though much weaker than is generally named, is amply sufficient if properly used. If the fixing solution is made too strong, it will rob the prints of their brilliant tones, and they will have a poor and weak appearance, as if they had neither been printed nor toned enough.

The temperature of the fixing solution is a matter of consequence. When it is very cold, the hyposulphite materially loses its solvent action. Hyposulphite of soda in dissolving deprives the water of much of its heat. Thus a solution of hypo is found to be much colder than the water that was used to dissolve the crystals. It is better, therefore, in cold weather to use warm water. The feel of the solution to the hands will always be a good test for its temperature. It should always be such as to be agreeable to the hands. It need never be warmer, but it should not be used when it feels cold. The crystals should be entirely dissolved before the prints are immersed in it. As much solution should be made as to allow the prints to be moved freely about in it. Not too many prints should be put in at once, and when they are in they should be separated from each other as quickly as possible, to allow the hypo to act. If the prints are allowed to adhere to each other, and air-bubbles to form between them, no end of trouble will be experienced, and the prints will probably be spoilt. All the prints should be got in as soon as possible after each other. Ten minutes will be sufficient time to allow them to remain in. They must be kept moving about and separated from each other the whole of the time. They may then be taken out and put in a large vessel of water, and the same process of separation repeated, so that the prints may as quickly as possible get rid of the adherent solution of hypo. When they are all separated and freely floating about, the water must be changed, and for the first half-hour the water must be renewed every few minutes, so as to remove the hypo solution which the prints are saturated with. This is the stage at which the most effectual washing can be done. The prints

may now remain in water, which should be changed many times during the night, the object being to deprive them of every trace of hyposulphite.

Final Remarks on Printing.—The author cannot conclude the subject without expressing his opinion that there is more real difficulty and trouble connected with printing than with any other branch of photography. The importance of the subject is too much under-rated—deemed work fit for women and boys. Printing of a certain kind is easily enough performed, but what good is it when it is done? To uniformly produce clear and brilliant prints without waste and loss is no trifling matter. The general principles are well known, but the subject, in practice, is beset with many little variations that cause vexation, annoyance, and failure. Though good formulæ be supplied, the experience derived from an endless number of experiments shows that every formula may occasionally be varied with advantage, according to the sample of paper used. The mechanical and chemical nature of the paper really forms an important part of any printing and toning process. The intelligent printer will, therefore, find much advantage in studying its nature, and adapting his chemicals to it. It is no use railing against paper and condemning formulæ: they must both be used, and it is better to try and make them harmonize. Paper cannot be made to suit the chemicals, so chemicals must be modified to suit the paper. Well-prepared albumenized paper is one thing, and a good toning process another; and the skill of the printer is shown by blending them so as to produce first-rate prints.

By recommending the use of vigorous negatives, by furnishing good working formulæ, and by urging the propriety

of slight modifications according to circumstances, the key is supplied for producing as perfect prints as the present knowledge of the art permits.

STEREOSCOPIC PICTURES.

The principle of Stereoscopic Pictures depends on the production of two pictures taken of the same object at slightly different points of view. Two ordinary cameras may be used, each provided with its own lens and its own plate; or the same camera may be used twice, moving it slightly on one side in the second picture, to obtain the necessary difference in the point of view. If the difference between the two points of view be considerable, the effect in the stereoscope will be that of exaggerated relief and distortion. Under all ordinary circumstances the best effect is produced by the use of the binocular camera, as the two lenses are then employed in the simplest and readiest manner, and the pictures produced have the relief of nature. It is also a great convenience to have both pictures on one glass, as one preparing of the plate serves for each. As the two pictures are thus exposed simultaneously, the same objects will be in both; whereas when they are exposed at different intervals of time, only still-life objects can be produced with certainty. The binocular camera is therefore recommended. In selecting the points of view, particularly in landscapes, it is especially desirable to have some objects in the foreground, otherwise the picture, when seen in the stereoscope, will be tame and flat. Sometimes a post, an old tree, even a few twigs, will be sufficient; but it is of the highest importance that some object should be there, so as definitely to mark the foreground, and then all other

objects will fall into their relative planes, and communicate the sense of relief.

When the binocular camera is used, the pictures, after being printed, must be cut and transposed, so that the right hand one shall be placed on the left, and *vice versâ*. When many copies are wanted, it is better to cut the negative itself, transposing the two halves, and then glue them by th corners to another glass, and thus the paper prints will be printed right at once.

In producing stereo negatives, a rather different treatment is required than for other pictures. It is not so much a brilliant picture, that may look well out of the stereoscope, that is wanted, as a soft and delicate one, that looks well in the instrument. In particular, there must be no masses of hard white light, or patches of deep black shadows without detail. The negative must be exposed sufficiently long in the camera to bring out all the details in the deepest shades; and in developing, the intensifying must not be carried so far as to fill up any of the details in the high lights. By these means a picture will be produced which, though somewhat lacking in brilliancy out of the stereoscope, will amply repay, by the beauty of its details, when seen in it.

HOW TO CLEAN THE SHADOWS OF A FOGGY NEGATIVE.

This must be done after the negative is fixed and washed, and before it is varnished. Make a solution of iodine 5 grains, iodide of potassium 10 grains, water 5 ounces. Pour this solution over the negative while it is wet, and let it float over it for about a minute, or until it loses its yellow colour.

Wash, and immerse the negative again in the fixing solution, allow it to remain about the same time as for fixing; wash well, and observe if the shadows are sufficiently cleared. If they are not repeat the process, and continue repeating it until they are cleared. The whole picture will then be reduced in intensity, and the negative must be re-intensified in the usual manner; but this second intensifying will be confined almost entirely to the high lights. The whole operation requires care and considerable patience.

ADVICE ABOUT CAMERAS FOR COPYING AND ENLARGING.

Pictures are sometimes required to be copied of an enlarged size. Small portraits, three or four inches square, enlarged to 10 by 8, or 12 by 10 inches, are the most usual examples. For this work a *copying camera* is required, that is, one with a long, expanding body, which should be of leather, accordion-fashion, so that it may be used at various distances.

The size of this camera will be determined in its width and height by the dimensions of the largest plates proposed to be used, and in its length by the focal length of the enlarging lens, and the number of times the copies are to be magnified.

Let a case be supposed: it is required to enlarge a picture on a $2\frac{1}{2}$ by 2-inch plate to fill a 10 by 8-inch one. For this work a good quarter-plate lens, provided with Waterhouse diaphragms, will answer. The equivalent focus of these lenses is usually about six inches. The enlargement required in the present instance is four times linear measure.

The distance the ground-glass should be from the back lens must be calculated to know the length of the camera required. The rule that determines this is simple and easy to be remembered: *Multiply the focal length of the lens to be used by the number of times of enlargement, and add the focal length to the product.* Thus, the picture is to be enlarged four times, the focal length of the lens is six inches: four times six are twenty-four; now add the focal length—six inches—and thirty inches is the distance for the ground-glass to be behind the lens; therefore, a camera that will expand to three feet will be ample. The distance for the picture to be placed in front of the lens is always more than the focal length, and less than twice the focal length; in this instance it will be 7½ inches.

If a different lens were employed, say a Dallmeyer's No. 1 triplet—an excellent one for copying and enlarging—the equivalent focus of which is nearly eight inches, a camera to do the above work would require to be 10 inches longer; but if a whole-plate lens with about 12-inch equivalent focus were used, the camera would have to be 5 feet long. The above examples will show that the focal length of the lens and the number of times of enlargement of the copy determine the length of the copying camera.

For further information on this subject, see the next article, where the subject, in connection with the table for enlargement and reduction, is still more fully stated.

TABLE OF ENLARGEMENT AND REDUCTION;

GIVING THE DISTANCES BETWEEN THE LENS AND THE OBJECT, AND THE LENS AND THE FOCUSSING GLASS, FOR ENLARGING OR REDUCING FROM THE SAME SIZE TO TEN TIMES THE SIZE OF THE ORIGINAL.

Focus of Lens.	Number of times of enlargement or reduction.									
	Same Size.	2	3	4	5	6	7	8	9	10
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
4	8× 8	12 × 6	16× $5\frac{1}{3}$	20 × 5	24× $4\frac{4}{5}$	28 × $4\frac{2}{3}$	32× 4^{4}	36 × $4\frac{1}{2}$	40 × $4\frac{4}{9}$	44 × $4\frac{2}{5}$
$4\frac{1}{2}$	9× 9	$13\frac{1}{2}$× $6\frac{3}{4}$	18× 6	$22\frac{1}{2}$× $5\frac{5}{8}$	27× $5\frac{2}{5}$	$31\frac{1}{2}$× $5\frac{1}{4}$	36× $5\frac{1}{7}$	$40\frac{1}{2}$× $5\frac{1}{8}$	45 × 5	$49\frac{1}{2}$× $4\frac{95}{100}$
5	10×10	15 × $7\frac{1}{2}$	20× $6\frac{2}{3}$	25 × $6\frac{1}{4}$	30× 6	35 × $5\frac{5}{6}$	40× $5\frac{5}{7}$	45 × $5\frac{5}{8}$	50 × $5\frac{5}{9}$	55 × $5\frac{1}{2}$
6	12×12	18 × 9	24× 8	30 × $7\frac{1}{2}$	36× $7\frac{1}{5}$	42 × 7	48× $6\frac{6}{7}$	54 × $6\frac{3}{4}$	60 × $6\frac{2}{3}$	66 × $6\frac{3}{5}$
7	14×14	21 ×$10\frac{1}{2}$	28× $9\frac{1}{3}$	35 × $8\frac{3}{4}$	42× $8\frac{2}{5}$	49 × $8\frac{1}{6}$	56× 8	63 × $7\frac{7}{8}$	70 × $7\frac{7}{9}$	77 × $7\frac{7}{10}$
8	16×16	24 ×12	32×$10\frac{2}{3}$	40 ×10	48× $9\frac{3}{5}$	56 × $9\frac{1}{3}$	64× $9\frac{1}{7}$	72 × 9	80 × $8\frac{8}{9}$	88 × $8\frac{4}{5}$
9	18×18	27 ×$13\frac{1}{2}$	36×12	45 ×$11\frac{1}{4}$	54×$10\frac{4}{5}$	63 ×$10\frac{1}{2}$	72×$10\frac{2}{7}$	81 ×$10\frac{1}{8}$	90 ×10	99 × $9\frac{9}{10}$
10	20×20	30 ×15	40×$13\frac{1}{3}$	50 ×$12\frac{1}{2}$	60×12	70 ×$11\frac{2}{3}$	80×$11\frac{3}{7}$	90 ×$11\frac{1}{4}$	100 ×$11\frac{1}{10}$	110 ×11

This Table (page 95) shows at a glance the distance the object must be in front of the lens, and the distance the ground glass must be behind, for reducing or for enlarging to ten times the original size of the object, and the calculations are for lenses from 4 to 10 inches equivalent focal length.

For enlarging, the figures on the left side of the × give the distance from the lens to the ground glass, and the figures on the right side give the the distance in front of the lens : for reducing, exactly the reverse rule applies. If the × be taken to represent the lens, the figures on each side will show how far before the lens the object must be put, and how far the ground glass must be placed behind the lens, according to the focal length of the lens employed, and the degree of enlargement required.

For single lenses the distances may be measured from the lens itself, and in Dallmeyer's triplets it may be taken from the diaphragm slot. An exact rule cannot be given for double combinations where the equivalent length of focus is unknown, but for practical use the point may be measured from the Waterhouse diaphragms, or, if they are not provided, from midway between the inner surfaces of the front and back lenses.

To use the Table : Suppose a picture has to be copied three times larger with a lens of 5-inch equivalent focus, and it is required to know how much the camera must be drawn out. By referring to the side column, "focus of lens," select 5, and on the horizontal line 3 will be seen $20 \times 6\frac{2}{3}$. The camera must be lengthened for the ground glass to be 20 inches from the lens, or the part measured from, and the object must be $6\frac{2}{3}$ in advance of the same point. If the lens were 8-inch focus, the Table shows that the picture must be $10\frac{2}{3}$ inches

in front, and the ground glass 32 inches behind the lens, and so on for various focal lengths and different degrees of enlargement.

HOW TO USE THE SOLAR CAMERA AND PRODUCE LIFE-SIZE PICTURES.

By the method of copying already described, pictures can be obtained considerably enlarged, and with a satisfactory degree of definition; but a bound is soon reached, in consequence of the weakness of the light when distributed over a large surface. To meet this difficulty, the Solar Camera has been invented by an American gentleman (Mr. WOODWARD), which supplies the means of illumination in so superior a degree, that a new impetus has been given to the production of pictures by enlargement.

The instrument is based on the principle of the solar microscope, and is intended to be used in direct sunshine. It consists of a large strong box, some 11 inches square, with sliding adjustments, like an ordinary camera. The front has adaptations for various lenses, but an ordinary half-plate portrait lens is the one usually employed. Inside of the camera, and near the back, is placed a large plano-convex condensing lens, 9 inches in diameter, 17 inches focus, with the plane side inwards. Firmly attached to the camera-back is a glass mirror, about two feet long, and nearly a foot broad. The picture to be enlarged is placed in a movable partition between the condenser and the portrait lens.

To use this instrument, a room with a south aspect is selected. A strong table or bench is placed under the window to support the camera. The camera is placed with its back close to the window, all the light from which should be stopped

out, except two portions, each about a square foot, through one of which the mirror should pass, and the other should be made yellow to see to work by. A few feet from the camera is placed a screen on which is received the enlarged image, magic-lantern fashion. This dark chamber becomes, in fact, a huge camera, in which the operator conducts all his operations. The picture to be copied must be a weak glass negative, with abundance of detail in the shadows, and not too dense in the high lights. An ordinary negative will not produce good pictures, being too opaque.

The picture should be very clear, clean, and sharp; it should not be varnished. Any size under a whole-plate may be copied, but a 5×4 or 1/2 plate is best. A sunshiny day must be selected, and the mirror so turned that it catches the solar rays and reflects them on the condensing lens. The size of the picture to be produced is determined by the distance the receiving screen is placed from the portrait lens; the further it is removed, the greater the enlargement. The apparatus must be so adjusted that, when the picture is exactly in focus, the solar spark produced by the condensing lens must be precisely in the centre of the front surface of the portrait lens. By means of rack-work attached, the mirror can be moved in any direction to follow the motion of the sun. These movements can be made *inside* the room, which is a great convenience. A picture can be directly printed on albumenized paper in from one to three hours; but the mode generally adopted is to use a "development" process, as described on a previous page. A few seconds' exposure is then sufficient. The developing is conducted as there described, and with moderately careful management, pictures can be produced much better in brilliancy, sharpness, rapidity,

and delicacy, than by any other enlarging means. So far as *size* is concerned, the operator is bounded only by the troubles of manipulation and *materiel*, otherwise there would be no difficulty in enlarging portraits to colossal proportions, and increasing half-plate pictures to ten feet dimensions. It is not to be supposed that the same degree of delicacy of definition is retained when this great enlargement is attempted, but the general truthfulness of effect and absence of distortion is really remarkable.

HOW TO MULTIPLY NEGATIVES.

It is often desirable to multiply a valuable negative. There are several methods of doing this, depending on the question of size. To obtain a duplicate negative the same size as the original, prepare a plate by any of the dry processes already described. Place the negative and dry plate in contact in a printing-frame, as in the ordinary printing process, and expose the frame to diffused daylight for a second or two, then develop the plate and a transparent positive will be obtained. Fix and varnish this in the usual manner, and use it with another dry plate in a similar way, and thus a duplicate negative is obtained. The transparent positive can be used to obtain an indefinite number of negatives. It should be very clear and distinct, and not very intense.

When the duplicate negative is required larger or smaller than the original, the operation must be different. Secure a room that has a window looking to the north sky. Place a shutter over this window, and cut a hole just large enough to admit the negative. Place the camera in this room opposite the negative, and adjust by moving it backwards or forwards, until the image on the ground glass is of the size you desire.

No other light must be in the room but that which comes through the negative. Take a picture now by the usual wet process, and you have a transparent positive. Put this transparent positive in the same aperture in the shutter, and proceed as before, and you will obtain a negative, and thus you can produce an indefinite number. If the above operations are cleverly managed, the resulting negatives, even though considerably enlarged, will have the characteristics of being taken direct from life, and will be superior to the best that can be obtained by copying from paper prints. Thin negatives with abundance of detail are those that copy best.

If it be inconvenient to obtain a room with a north window as described, another method of operation is by the use of the "copying camera for transparencies." This instrument, and the mode of using it, is described in the article on "Transparencies for Decorating Windows," &c., to which the reader is referred.

INTENSIFYING PROCESSES.

When developing with iron, it is always a good thing to obtain as strong a deposit as possible, in the first instance; with some samples of collodion and in good light, a vigorously printing negative can be obtained at once by the iron; usually, however, the deposit requires some addition to complete the required opacity, and occasionally, especially with short exposures, the first deposit is so very thin and weak, that great trouble is experienced in making a negative having good printing qualities. It should be remembered that all intensifying processes have a tendency to produce hardness and destroy half-tone, therefore great care is required in using any of them. There are three stages

during which a negative may be intensified :—Before the yellow iodide of silver is dissolved out; after the iodide is dissolved, and while the film is still wet; and also when the film is entirely dry.

The following are the most approved methods for intensifying after the picture is developed and before dissolving the iodide out :—First wash the plate thoroughly, to remove the iron solution; then pour on the plate a little nitrate of silver solution, strength 20 or 30 grains to the ounce, taking the precaution to add to the silver solution the same proportion of acetic acid and alcohol that the developer contains. Unless this is attended to, the two solutions will not readily mix on the plate. Let the silver solution flow backwards and forwards over the plate, to mix well with the water on the surface, and then pour over a fresh portion of the iron developer previously used. The developing will begin anew, and if the negative only need a little strengthening, this method will quickly answer. The solution may be poured on and off the plate until it becomes muddy, when the operation may be repeated, with fresh quantities of the silver and developing solutions, until the desired density is obtained. This operation must be entirely conducted in the dark room.

Another method of intensifying with iron is to prepare the following solution :—

Protosulphate of iron	1 drachm
Citric acid	2 drachms
Water	12 ounces.

A quantity of this solution may be made up at a time, as it improves by keeping. It is to be used in the same manner as the former one : after the plate is developed by the usual

iron solution, pour off, and continue the development with this solution, to which the silver solution is to be added, instead of pouring it on the plate. Pour on and off until the desired density is obtained, renewing with fresh solution and silver if required.

Instead of iron and silver, a more usual method is to employ pyrogallic acid :—

Pyrogallic acid	1 grain
Citric acid	1 „
Water	1 ounce.

Pour this solution on the plate so as to mix well with the water; pour it off into the developing-glass, and then add some silver solution, and continue till sufficiently intense. This plan is an excellent one for producing soft yet vigorous negatives, and is one that can be strongly recommended as applicable under almost all circumstances.

Some operators prefer to strengthen their negatives in the second stage; that is, *after* they have dissolved the iodide of silver, and while the plate is still wet. There are several plans of doing this, and those that depend on the reduction of silver must all be done in the dark room. In all instances the cyanide or hypo must be thoroughly washed away before commencing to intensify.

When the negative has been thus fixed and washed, and it is found to be not sufficiently dense, the following methods may be used. If only a slight increase of intensity is required, a little silver solution may be flowed over the plate, and the iron developer may be employed in the manner previously described. By this method the silver is apt to be thrown down in a grey crystalline powder, which is not favourable to opacity.

A better plan is to use the pyrogallic and silver as in a preceding method, the colour being thus changed to a non-actinic brown, which produces great intensity.

When the plate has been fixed and washed, a good intensifier—if the picture does not require much strengthening—is a solution of chloride of gold, 1 grain to the ounce. It has only to be flowed over, and the effect is produced immediately, by changing the previously grey deposit to a nearly black colour.

Bichloride of mercury was formerly in great request as an intensifier; it then fell into disuse, and has recently come into favour again. It is very powerful in its action, and requires to be used with great care, as it has a tendency to produce hardness, and to rot the film. These latter defects may, however, be remedied by employing clean glasses, suitable collodion, and by a more sparing use of the bichloride itself. A convenient strength is about two grains to the ounce of water. This will form a solution sufficiently strong to serve for all the processes in which it is hereafter alluded to. It should be poured uniformly over the film, to avoid stains; it produces its effect in a few seconds, changing the surface of the negative to a blackish grey. If allowed to remain on long, it would change to a white; this must never be done, or the delicate half-tones will be lost. When the plate has acquired this dark grey colour, which it will in a few seconds, wash it well, and pour over it a solution of iodide of potassium (2 grains to 1 ounce of water), which will turn it to a dirty greenish grey colour, not pleasant to look at, but an excellent one for printing. If the iodide solution turn the film a bright yellow, the bichloride solution is too strong, or has been allowed to remain on too long. The bright yellow colour is nearly useless for printing.

Instead of the iodide, a weak solution of hyposulphite of soda may be poured over, which will change the colour to a rich brown: or a dilute solution of ammonia may be used, altering it to a blackish colour.

Another intensifying solution, based on the same principles, is composed thus:—To a saturated solution of bichloride of mercury add a solution of (say) 10 grains of iodide of potassium to 1 ounce of water; a red precipitate will soon form, and the iodide solution must continue to be added till it redissolves the precipitate, and becomes clear again. This solution has great intensifying powers, and may be used in preference to those already named, the same precautions being required not to over-do the intensifying.

Another plan for strengthening a weak picture after the iodide is dissolved out, and while the plate is still wet, is to pour over it a solution composed of iodide of potassium 2 grains, iodine 1 grain, water 1 ounce. Allow it to remain on the film about a minute or two, then wash well, and pour over the usual pyrogallic solution, to which a few drops of silver have been added, as if continuing the development. If the required intensity be not produced by the first application, the iodine solutions and pyrogallic and silver may be alternately used, washing well between; and thus almost any amount of intensity may be obtained, even from a weak negative. The use of the iodine solution is not sufficient itself to produce intensity, but it alters the condition of the film, and enables it to receive a fresh addition of deposit from the pyro and silver solution to be afterwards used.

Some persons prefer, after they have dissolved out the iodide, to let the plate dry before intensifying. Excellent pictures may be produced by this method, but, as there is an

increased tendency to produce harshness, the greatest care must be taken. The plate should be thoroughly dried, and the film should be varnished with the usual varnish (using a camel-hair brush) about a quarter of an inch all round: this is to prevent the film leaving the glass when it is re-wetted. The surface should then be well wetted, and any of the intensifying methods already described may be proceeded with; the best effects have, however, been produced by the application of the bichloride of mercury solution, succeeded by the iodide of potassium.

When bichloride of mercury is used as the intensifier, the plates should be allowed to dry spontaneously, as the application of heat sometimes causes the film to break up, when it otherwise would not have done so. If the film on drying shows fine crapy lines, especially in the intensest parts, the fault lies in the collodion; it contains too much water, and is not suitable for the process.

All the above methods may be safely relied on for producing the effects attributed to them; but some, especially the bichloride ones, require judgment and experience. They must not, therefore, be hastily condemned if the first trial or two be not successful. Some processes succeed better in one person's hand than in another's; the best plan, therefore, is to adhere to that one which succeeds best, for, after all, the final result depends, not so much on the process, as on the person who uses it.

HOW TO INTENSIFY NEGATIVES AFTER THEY ARE VARNISHED.

When a negative has been once varnished, its character is supposed to be so settled that it is beyond the reach of alteration or improvement. It is certainly the best plan to so consider it; yet, sometimes, a negative becomes so weakened in the varnishing as to cause great disappointment. It is a consolation to know that a negative need not be given up as hopeless, even under these circumstances. The method of proceeding is to make a "Negative Intensifying Varnish" by adding tincture of iodine—alcohol 1 ounce, iodine 10 grains—to any good negative spirit varnish, until of a very deep sherry colour. Label the bottle, and keep it for special use. When a negative prints weak and without sufficient contrast, re-varnish with this varnish; pour on in the usual manner, allowing a few seconds for the yellow varnish to penetrate the film, and dry by heat in the usual manner of varnishing the plate. The negative will be found to be changed to a more non-actinic colour that will take longer to print, and will produce a more brilliant impression on paper. Many weak, thin, foggy negatives may thus be made to produce passable prints. It is well to keep two varieties of this yellow varnish, one, of an ordinary sherry colour, for negatives that only want a little intensifying; and another, with a very deep port wine colour—by adding a greater quantity of tincture of iodine—and using this latter for negatives that are very weak and grey. Used with care and judgment, there is no question but that these varnishes will be found extremely useful in every photographic laboratory.

A varnish of this character may also be used with ad-

vantage for varnishing the plate in the first instance, if the negative is found to be not quite intense enough, as the iodine in the varnish unites with the silver deposit, and makes the deposit much more chemically opaque than the ordinary varnish, thus increasing the intensity of the negative.

It is scarcely necessary to say that judgment must be exercised in employing these expedients, and, though useful in cases of extremity, they should never be considered as the regular practice.

WHAT USE IS ALCOHOL IN THE DEVELOPER?

It is not generally understood the exact part that alcohol plays in a developing solution. Photographically, it is inert: it neither develops like the pyrogallic acid or protosulphate of iron, nor checks and controls like the acetic and citric acids. It acts only as a *mixer*; it makes the developing solution more of the nature of the nitrate of silver solution that floats on the plate. When a plate is excited in a newly-made nitrate of silver bath, a developing solution without alcohol will readily flow over it; but as the bath becomes used, some of the ether and alcohol from the collodion is dissolved in the bath, and the plate then becomes more *oily* on its surface, and more repellent of water. A developer without alcohol will not, under these circumstances, flow easily over; it hesitates, flows over the edge, and will not readily mix with the nitrate of silver, because the latter, holding ether and alcohol in solution, repels it. In such a case alcohol, added to the developer makes it more like the nitrate of silver solution, and hence they readily mix. From this it is seen that the newer or less used the nitrate bath, the less alcohol is needed in the developer; and also, that the older the bath, or the more

ether and alcohol it contains, the more there is required in the developer. When the latter, therefore, does not readily mix with the nitrate solution on the plate, as much alcohol must be added as will make it easily blend.

The quantity of alcohol required in the developer cannot be a constant quantity; it always varies with the condition of the bath and other things; with a new bath none is required, but with an old used one as much as a drachm to each ounce of solution may be necessary. In summer, more is needed than in winter; strong developing solutions require more than weak ones; and the less the quantity of acetic acid, the more need for the alcohol. No formula can, therefore, ever give the exact amount required, but each person, when the real use is known, can add just the quantity, and no more, that his plate requires. In place, therefore, of naming an exact quantity in a formula, a very sensible practice is being generally adopted of giving "*quantum suff.*" as the proportion of alcohol.

CLEANING AND RESTORING DAGUERREOTYPES.

These pictures frequently become obscured with a bluish film, and the picture is then said to be faded or "gone." This is a mistake, for with a little pains they can be made as perfect as ever. Carefully remove the matt and glass, paying special attention not to touch the face of the plate in this or any of the after operations, for the least touch will leave a mark that can never be removed. If any gum-paper adhere at the back, moisten and remove it. Hold the plate face upwards, resting it on the tips of the fingers, and allow water from the tap to flow over it; then pour over its surface a freshly-made solution

of cyanide of potassium, about five grains to the ounce. Let the cyanide flow backwards and forwards till the discoloured film is dissolved off. Sometimes an obstinate patch will remain after the rest of the plate is clean; pour the cyanide off and on at this place, as if developing, and it will disappear.

Be careful not to use the cyanide too strong, or the picture itself will be dissolved away. It is better to employ quite a weak solution and take a little more time, than run a risk of injuring the picture. Sometimes a solution of hypo—which never injures the plate—or even plain water, is sufficient to remove the obscuring film. If these means fail, cyanide will always be found successful. When the stain is all dissolved, wash the cyanide away, finishing with a swill of distilled water, and dry the plate over a spirit lamp. The plate must not be allowed to dry spontaneously, like a glass one, but must be finished off at once with direct heat. A pair of pliers should be used to hold the plate while drying, and the water should be made to evaporate from the upper corner downwards in one steady, uniform wave, otherwise stains will occur. It will be impossible to dry the plate off clearly unless the last wash is with distilled water, as common water, on evaporation, precipitates its impurities on the plate.

If the above precautions be taken, the Daguerreotype may be restored to all its original beauty.

HOW TO COPY ENGRAVINGS, ETC.

NOTHING is easier than to get a common copy of an engraving, but to get a first-rate one requires care and skill.

The engraving, print, or drawing should be mounted quite flat on a substantial board, so that there are no markings of

folds, or inequalities on the surface. The engraving should be placed exactly square with the front of the camera, and its centre should be exactly opposite the lens. The camera should be quite level. The picture should be placed in a good diffused light. Sunlight is not good, as every little irregularity in the paper will cast a minute shadow which will give a coarse granular effect to the negative. The light should fall on the picture from above and from each side—in fact, from every direction—so that not only every part may be equally illuminated, but that the light from different directions may neutralize and destroy the minute shadows of the irregularities of the surface of the paper.

In taking a portrait, every effort is needed to avoid flatness, and preserve roundness, and this is chiefly done by the arrangement of the light; but in copying a print, which is a flat surface, equal skill is needed, by managing the light, to produce the effect of perfect flatness. This is to be done by allowing the light to come in all directions. While it is thus allowed to cover the print, the extremest means must be adopted to so screen the lens, that no light enters it excepting that reflected from the object copied. It will be also well to have a diaphragm in the body of the camera between the lens and the plate, to intercept the stray light that falls on the internal sides of the camera.

The best lens to use is a doublet or triplet, as with these the marginal lines are given absolutely correct. If a portrait lens be used, it must be stopped down, so that the extreme edges are as sharp as the centre.

The nitrate bath should be in such condition that it has no fogging tendency whatever. Perhaps the best developer is pyrogallic acid. The organico-iron developer is also very well

adapted. If the ordinary iron solution be used, it must be employed very weak (say five or six grains per ounce), with half a drachm of glacial acetic acid. The exposure must be sufficient to yield a dense deposit for the whites, but the blacks must be represented by bare glass. Over-exposure must be carefully guarded against. The developer must not remain on sufficiently long to cause the slightest foggy deposit on the blacks. The collodion should be very clear and clean, and should produce a uniform creamy film. The addition of a grain per ounce of chloride of calcium or other soluble chloride to most samples will produce a suitable collodion for giving a dense image, while the blacks are represented by bare glass. The intensifying of the image will be best effected after it is fixed. If the picture is not perfect at this stage, it will be better at once to rub it off and take another, rather than waste time in attempting to amend it. Such attempts generally end in failure, and, except for experiment sake, should not be recognized. Good work is never made by dodging and doctoring.

If the picture is quite good excepting a slight deposit on the blacks, recourse may be had to Mr. Osborne's "clearing" process; see article on "How to Clear the Shadows of a Foggy Negative."

The varnishing should be as carefully performed as every step in the process. If a negative be obtained in which all the named precautions are taken, it will fully repay, in the brilliant prints obtained from it, for all the care taken.

ABOUT CLEANING AND USING GLASS PLATES, NEW AND OLD.

An excellent starting point of success is to obtain a nice clean plate. A good operator knows that unless his glass is clean he has no security for obtaining a perfect picture. Many different methods have been given for effecting this apparently simple object, but the plan that seems to be perfection with one person is declared to be useless by another.

New glass plates are always best; old plates, many times used, or that have laid about with their dirty surfaces, or that have been varnished, are always to be regarded with suspicion. It is very doubtful if there is any saving in using a plate that has once been varnished. A truly economical photographer will have the courage to use the hammer to lots of his old glass, rather than risk his materials, his time, and his temper on plates which may give only dirty pictures. The chemicals, especially the protosulphate of iron and cyanide of potassium, seem to act on the surface of the glass, so that, after much using, no amount of friction with acids or alkalies will prevent smears, marks, *ghosts*, comets, rockets, and other abominations. New glass works well with very little cleaning. Patent plate is always the best; but for small sizes up to 5 by 4, "flatted crown" will do, and "polished sheet" for larger sizes. It is a good plan, if there be a doubt whether the glass plates are flat enough, to put them into the printing-frame, and apply quite as much pressure as will occur in printing, for few things are more mortifying than to break a negative through using glass not flat.

To prevent cutting the fingers and tearing the cloths, the glasses should have their sharp edges and corners taken off;

and, to make the collodion adhere well at the edges, it is better if they are roughened a quarter of an inch all round. Sand paper, emery cloth, sandstone, or a little grooved instrument made of corrundum, and sold for the purpose by most photographic dealers, may be used.

New glasses may be simply washed under the tap with plenty of water, and dried on clean cloths. When quite dry, place the glass in a plate-cleaning holder, and pour on a few drops of pure alcohol; rub this well over the plate on both sides with a tuft of cotton wool; with a second tuft rub off the alcohol, and with a third one polish the plate. This will be found a safe and expeditious method of cleaning plates. The last tuft of cotton should be kept quite clean and dry, so as to leave the plate without lines or smears. If the reader has much trouble with dirty glasses, he is strongly recommended to try "Werge's Plate-Cleaning Solution." The writer has used it for years, and is never troubled with dirty plates, and he feels he is doing his readers a service in calling their attention to this very useful preparation.

Every dark room should have a large dish provided, half filled with clean water, into which all spoiled plates should be immediately immersed, so that the collodion film should not dry on the plate. By this plan much time will be saved in cleaning the glasses, and the plates will be kept in better order. The plates should not be left to lie in this water any longer than possible, and the water should be frequently changed. The fragments of collodion films should be added to the pan in which the silver residues are kept, as they all help to swell the amount.

TO CLEAN PLATES THAT HAVE BEEN VARNISHED.

Soak the plates in a saturated solution of common washing soda and allow them to remain until the film comes off without any friction. If the solution be made hot, a few minutes will be sufficient; but cold, they usually require from twenty-four to forty-eight hours' soaking. When the film leaves the glass freely, wash it well under the tap, and immerse the plates in weak nitric acid (water 5 ounces, nitric acid 1 ounce) for a short time. Wash well again, dry, and treat it as a new glass.

As the varnished side can never be much depended on, it is a good plan to mark the *unvarnished* side with a diamond before cleaning, and to use the marked side for putting the next collodion film upon.

TRANSPARENCIES FOR DECORATING WINDOWS, AND FOR THE MAGIC LANTERN.

A very interesting application of photography is the production of transparencies for window decorations and for the magic lantern. They may be produced by the dry or the wet process. The first proceeding is to obtain a suitable negative. It should be clear, clean, and very sharp. The high lights should not be too opaque, but full of half-tone, and the shadows free from fog and full of detail. There ought to be an entire freedom from all smears, markings, stains, spots, and comets. Although there is no fixed size for the magic lantern, yet 3¼ inches square is a usual size, and for which the ordinary stereoscopic negative is well adapted; but every person will, of course, make the pictures the dimensions to suit either the lantern he uses, or the window he wishes to

ornament. If the negative be the same size that the transparency is wished, the proceeding is very simple, as any of the dry processes may be employed—the tannin by preference, in consequence of the rich tone it gives. The negative has to be placed in the printing-frame, and the dry plate put in contact, as in ordinary printing. A few seconds' exposure in diffused light, varying with the intensity of the negative, will be enough; or gaslight may be used, when a few minutes will be necessary. The plates must be developed according to the directions given for each process. If gallic acid be used, the resulting picture will be a greenish-black tone; pyrogallic and citric acid yield a bluish-black, and pyrogallic and acetic acid a brown-black tone. The tannin process gives a rich chesnut brown that is much admired. The picture, if intended for the magic lantern, should not be varnished, unless the blacks are foggy, but mounted by putting another glass the same size to protect the collodion film, and binding the edges like a passe-partout. If intended to be suspended as a transparency, it should be varnished and the collodion side protected with a *ground* glass. The edges may be secured like a passe-partout, to keep out the dust, and may then be framed according to taste.

If, however, the negative from which the transparency is to be made is larger or smaller than the size required, the lens and camera must be employed, and the negative must be copied *by transparency*. Many methods of doing this will suggest themselves to ingenious persons; one of these is by placing the negative in a window, all the rest of which is darkened, and copying the negative by the light that thus streams through it; the rest of the room must, of course, be in complete darkness. This method is described in the

article "How to Multiply Negatives," but the neatest plan is by the use of a "copying camera for transparencies." This instrument is a kind of double bellows-bodied camera; that is, another body is provided *before* the lens, in addition to the usual body behind it. This extra body is provided with sliding holders, to receive different sized negatives. The screen carrying the lens can be freely moved backwards or forwards, so as to approach either the negative or the ground glass, so that either a reduced or an enlarged copy may be made. To use the camera, place the negative in its holder at one end and the usual ground glass in the other, screw the lens on to the central screen, and put it in its place. If the copy is required to be exactly the size of the original, place the negative twice the focal length in advance of the lens, and the ground glass the same distance behind. If the size is to be reduced, push the negative further from the lens, and put the ground glass nearer; if it is to be increased, reverse the plan, putting the negative nearer and the ground glass further from the lens. How much nearer or how much further the lens must be from the ground glass, or from the negative, depends on the focal length of the lens, and on the desired degree of enlargement or reduction. This point may, however, be remembered, that neither the ground glass nor the negative must be put so near to the lens as its focal length, or no image will be formed.

The adjustment made, the camera may be inclined to the north sky; and the light streaming through the negative will form its image on the ground glass in the usual manner. A quarter-plate double combination lens, with central diaphragms, will be found very convenient for this work. First focus with open aperture, then put in the smallest stop, and

proceed as if for producing an ordinary negative; but instead of a negative, a transparent positive will be produced. The tannin process has already been noticed as serviceable for this work, but any other may be employed. Most usually the ordinary wet method will be found the easiest and simplest. Pyrogallic acid or iron may be used as a developer, the former by preference, as yielding a better tone and denser image. If the latter be used, and the tone be not approved, intensify, after fixing, with pyro 2 grains, citric acid 1 grain, water 1 ounce; or, to produce blacker tones, wash the plate well from the hypo or cyanide fixing solutions, and pour on a saturated aqueous solution of bichloride of mercury, until a grey appearance is seen on the plate, then wash well, and apply solution of iodide of potassium, 2 grains to one ounce of water, which produces a greenish-grey image; wash well, and finish with a solution of ammonia 1 drachm, water 1 ounce, which will change the image to a black colour. If the first deposit from the developer was not very dense, these operations may be repeated; the densest blacks may be obtained by these means.

It has already been stated that the pictures for the lantern need not be varnished. If, however, varnish be used, crystal varnish, drying without heat, will be found better than a thick spirit varnish, which would probably show markings when magnified on the screen. If the picture, on drying, be found too opaque, varnish will be found to restore transparency.

HOW TO REMOVE SILVER STAINS FROM THE HANDS.

Recent stains on the hands are more easily removed than old ones. On the same day they are made they may be

easily taken away. Wash the hands well in hot soap and water, and get off the adherent metallic silver with a nail-brush, then rub the stain with a flat piece of pumice-stone; if the skin be not too tender, the greater part of the stain may thus be removed. Finish with a piece of cyanide of potassium, and, while the hand is still wet, rub the part gently with it, and the stain will disappear.

Older stains are not so easily removed. It is a good plan to use all available mechanical means before having recourse to chemical ones to remove the stains; hence the hands should be well washed with warm water with plenty of soap; this softens the hard skin: next use the pumice-stone, and with friction remove the mark as much as possible without making the skin smart. Take a crystal of iodide of potassium, and, just dipped in water, rub it on the mark till it changes it to a yellow patch, wash, and use the cyanide till it disappears.

Another method is to keep a saturated solution of cyanide of potassium in one bottle, and a solution, ten grains to the ounce, of iodide of potassium, to which has been added as much iodine as it will dissolve. Touch the stain first with the iodide solution, wash, and then use the cyanide, rubbing it on the yellow stains. The skin on the back and sides of the hands is more delicate than on the inside, and will not bear much friction.

The stain on the hands, if left alone, generally disappears in about a week. The nails are more difficult to clean; scraping with a penknife, after the rest of the hands have been cleaned, is the best proceeding.

Cyanide must never be used to the hands when the skin is cut, scratched, or in any manner injured, as not only

immediate pain, but ultimate danger, may result from the absorption of the poison.

REMOVING SILVER STAINS FROM LINEN.

Stains should always be removed from linen before it is sent to be washed and ironed. The heat from the ironing tends to make them more indelible, and always renders the removal more difficult. Wet the part stained, and put on a few drops of a saturated solution of cyanide, or rub it with a solid lump; if the mark does not quickly disappear, wash, and put on a drop or two of the iodine solution mentioned in the preceding paragraph; the stain will now quickly change colour, and a little cyanide will easily dissolve it. When the linen is double, and the stain goes through, the solutions must be applied each side.

REMOVING YELLOW IRON STAINS FROM LINEN.

Sometimes operators' wristbands are as much stained by the iron as by the silver solutions. Yellow stains, commonly called iron mould, are easily removed by hydrochloric acid, or hot solution of oxalic acid, washing well in warm water afterwards.

ON THE PREPARATION OF THE IRON DEVELOPER SO AS TO PRODUCE DENSE NEGATIVES.

When nearly the right amount of intensity is supplied by the iron in the first instance, the plan of giving a little increased density to the high lights of a negative by pyrogallic and silver is a very satisfactory mode of working; but when the original deposit is thin, grey, and metallic, then is felt the shortcomings of the iron developer; for not only does the

image require a great addition of strength, but it also unwillingly takes the intensity. Under these conditions the picture requires several applications of the pyro and silver; the image has to be built up; and when the required density is produced, there is usually found a considerable loss of delicacy. The more forcing the image requires to become dense, the less satisfactory is the result. In a well-constructed portrait studio, and with skilful manipulation, this defect, the absence of primary intensity, exists in the least degree; but it is chiefly found in working in the open air, where the sky forms a large portion of the picture; or in using samples of collodion containing a large degree of bromide; in copying some kinds of pictures; in using a collodion giving only a thin and blue film; and in using weak nitrate baths.

Next to nitrate of silver, no substance has engaged so much photographic attention as gelatine. In the beginning it was pressed into the service of photography; and, more or less, through thick and thin, it and photography have stuck together to the present hour.

Gelatine added to the iron developer appears to act beneficially, both mechanically and chemically. By the increased glutinous properties it gives to the solution, it seems to flow more steadily and certainly over the collodion surface, so that, not hesitating or running into irregular lines, it does not cause the stains and markings that it otherwise is prone to. By this means the developer may be poured on more deliberately, and less solution will be required for the plate; the quantity of nitrate of silver thus becomes less diluted; and from this cause it tends to produce a more dense picture. The gelatine acts chemically by restraining the iron from

acting with its usual violence, so that the silver, instead of being very quickly deposited, is done so more slowly, and in the ratio of the action of light itself. It also causes the deposited silver, instead of being thin and grey and transparent, to be dense and brown and more opaque. Moreover it has a great tendency to prevent the silver depositing where the light has not acted, thereby keeping all the deepest and faintest shadows very pure; thus relatively increasing the density of the negative.

There are several ways in which gelatine may be added to the iron developer. Mr. Cherrill's method is well adapted where considerable intensity is required, as there is no difficulty in obtaining any amount whatever. Mix 1 ounce, by measure, of ordinary sulphuric acid with 1 ounce of water; let them cool. Then add 120 grains of gelatine; when dissolved, add a few ounces of water (say 5) and neutralize with ordinary ammonia. Add an ounce of glacial acetic acid, and make up the total quantity to 20 ounces of solution. To form a developer, prepare a 20-grain solution of protosulphate of iron, and add to each ounce from 10 minims to 1 or even 2 drachms of the above sulphuro-gelatine mixture, according to the intensity desired, remembering that the intensity will be just in proportion to the quantity of the mixture added.

The next developer is the one I most recommend:—

Glacial acetic acid...	2 ounces
Distilled water	8 „
Nelson's gelatine	120 grains

Mix these together, and in a short time the gelatine will dissolve. A little agitation, or the application of heat, will facilitate the dissolution. Then add to it—

Distilled water	...	...	... 70 ounces
Protosulphate of iron	...	...	2 „

This developing solution does not keep very well, and should not be made in large quantities. In cold weather it is apt to gelatinize, but a little warmth sets it all right. This solution flows like oil on the plate, readily mixing with the free nitrate, and has little tendency to form stains and streaks.

The image comes out slowly and steadily, and not with a flash. The high lights, if the exposure be rightly timed, will be found to have nearly or quite the right density by the time the detail is out. If not sufficiently dense when fully developed, the solution may be poured on and off, and the density will increase; or a little fresh solution may be taken, to which a few drops of silver have been added, and any amount of intensity may be obtained. The images dry intense, and are not much reduced in varnishing.

These solutions admit of great variety of preparation, but whichever be used, persons are urged to take care and not make their negatives too intense. There is such a tendency in that direction, and this form of developer gives great facility.

HONEY AND IRON DEVELOPER.

With a view to improving the character of the iron developer, Mr. Wharton Simpson has proposed the addition of honey to it. The following is an excellent formula:—

Protosulphate of iron	...	...	1 drachm
Glacial acetic acid	...	...	1 „
Alcohol	...	...	1 „
Honey (by weight)	...	...	½ ounce
Water	...	...	4 „

The honey may be the usual kind obtained from the druggists. This developer behaves considerably like the gelatine one, yielding a dense soft negative. It gives a nice colour to the deposit, and flows easily over the plate.

HOW TO TAKE TWO OR MORE PORTRAITS OF THE SAME PERSON ON A NEGATIVE.

THERE is more than one way of performing this ingenious piece of photographic magic. The best plan is as follows:—Let a frame be put inside the camera, as close as can be to where the dark slide fits in. Let this frame have two folding doors or shutters opening in the middle, and provided with handles, so that they can be opened and shut from the outside of the camera. Make a mark down the ground glass corresponding with the join in these shutters. Now close one half of the shutter, and pose your sitter so that he shall be completely seen on the open side of the ground glass. No portion of his figure must pass into the dark side. Take the focus *accurately*, and then, without moving the focus of the instrument, or without changing any of the accessories, close the side of the shutter that has been open, and open the other side. Pose the sitter again, so that all his figure shall this time be complete, and not pass into the covered half. A plate may now be put in the camera, and each half be exposed in succession, the sitter passing from one side to the other for each exposure. It will be important that the exact position be taken up each time, so that each half is perfect. If there be any difficulty in arranging this, each half of the picture may be separately examined on the ground glass before taking the other; but the precaution must be observed that a focus be taken that will suit for both halves, for when it is once taken it must not be

re-adjusted for the second half. There is no necessity that the join between the shutters should be a straight line, or that it should be in the middle; any line of separation that suits both halves will do, if they correspond with each other. If more than two figures are required on the plate, as many additional shutters, or portions of a shutter, will be required as there are separate figures, and all the parts of the shutters must correspond. A separate exposure for each will, of course, be required. It might be supposed that there would be markings on the plate, showing the joinings; but this will not be the case, for the light glides off and on imperceptibly, from one side to the other, if the apparatus is properly made.

By this ingenious plan a number of apparently impossible pictures may be obtained. A person at the one time may show his profile and his full face, the front and the back of his head; he may be laughing and crying; in plain dress and uniform; and under numerous other incongruous conditions.

HOW TO ARRANGE THE LENSES IN A PORTRAIT COMBINATION.

The lenses in a portrait combination are occasionally removed from their cells for the purpose of cleaning. Generally speaking, it is sufficient to unscrew the mountings, and wipe with chamois leather the two surfaces exposed. They can then be easily replaced; for the brass fittings are usually so made, that, if by mistake the cells are screwed into the wrong places, the hood, or projecting shade, will not go on. The mistake is, therefore, easily detected and corrected. When, however, the lenses themselves are taken out of their cells—and, except for curiosity, this is rarely required,

for the inner surfaces do not become dirty like the outer ones —the case is very different, for they may be variously transposed, and thus rendered incapable of producing good pictures. There is risk also of breaking one of the glasses of the back lens in screwing it in, unless it be put together in the proper manner. Many good lenses have been condemned as hopelessly bad through being thus transposed.

In a portrait combination there are four lenses in all, the so-called *front* and *back* lenses being really each formed of a pair. The front ones are always cemented together, and may thus be easily taken for one lens; the back pair are distinct, and are usually separated from each other by a narrow ring.

To place them in their proper positions, proceed as follows:—Take the front lens—the pair cemented together —and observe that one surface is considerably curved, and the other almost flat; place the lens in its cell, so that when screwed into the tube the curved side will be to the sitter. The two glasses forming the back lens are very unlike each other; one is thick at the centre and thin at the edge, the other thick at the edge and thin at the centre; put the thin-edged one first into the cell, resting on the least curved side; next put in the ring, and then the thick-edged glass, concave side towards the other lens; fix them in their places with the part provided, and screw the cell in its place.

With many portrait lenses there is an arrangement whereby the front lens may be used as a landscape lens; to use it for this purpose proceed as follows:—unscrew the back lens and lay it aside altogether, as it is only required in the *double* combination. Then remove the brass hood before the front lens; next unscrew the front lens, and rescrew it in

the place where the back lens was. In doing this the *flat* surface will be presented to the object. The lens tube may now be put on the camera, and the Waterhouse stops will be in their proper place for use. As the focus of the front lens, when thus used singly, is much longer than when used in combination with the back lens, the picture it will yield is proportionally larger, but a much smaller stop must be employed than when the lens is used for portraiture. The exposure will be considerably greater than when the double combination lens is used.

The front lens will, of course, have to be put in its former place, and the back lens restored, to fit it for taking portraits.

CABINET PORTRAITS.

The success of the carte-de-visite has induced enterprising photographers to extend the idea; hence the "Cabinet" portraits. These may, in one sense, be considered as cartes of a large growth, but the size is improved in its proportions. The same treatment should be used in producing these pictures, as in cartes; that is, as full-lengths, vignettes, &c., and with the usual accessories characteristic of indoor or outdoor scenery. A different lens will be necessary, as those used for the cartes are too short in focus. A half or whole-plate lens, or one made expressly will answer best.

The adopted size of the cabinet portraits is as follows:—

Size of mounted picture ...	... $5\frac{1}{2}$ by 4
Mounting card	... $6\frac{1}{2}$ „ $4\frac{1}{4}$
Opening in album	... $5\frac{1}{4}$ „ $3\frac{7}{8}$

There can be little doubt but that, by united action, this size may become a standard one, especially as albums are

constructed expressly for it. This new size, among its many advantages, is well suited for portrait groups, interiors, landscapes, and many other subjects for which the dimension and proportion of the carte are quite unfitted. It will also afford a worthy opportunity for skilful photographers to break away from the little and petite effects that are of necessity peculiar to the carte size, and may lead the public to appreciate and desire larger pictures and better work, thus improving the art in every way.

HOW TO PRODUCE OPALOTYPE PICTURES.

When pictures are printed on opal glass instead of albumenized paper, they possess a peculiar beauty due to the nature of the glass. Any method for producing glass transparencies will also serve for these pictures, only the printing should not be carried so far. An over-printed opalotype is always a good transparency.

Opalotypes by the Wet Process.—It is only necessary to use opal glass instead of patent plate, and all the directions that are given in the article "How to Produce Transparencies for Decorating Windows, &c." exactly apply. Should the colour of the picture not be agreeable, it may be toned with gold by any of the usual processes, taking care to use the solution about one quarter the ordinary strength.

Opalotypes by the Dry Method.—Any of the dry processes may be employed, and the plate may be used, either in the camera, or by direct contact in the printing frame. The development may be conducted the same as for a transparency, and, after fixing, may be toned the same as by the wet process.

Opalotypes by Chlorized Collodion.—To 3 ounces of ordinary

plain un-iodized collodion, add 1 ounce of alcohol, containing 40 grains of chloride of calcium. Prepare a 40-grain bath of nitrate of silver to which is added 1 grain of citric acid per ounce. Coat the plate with the *chlorized* collodion, and, when set, sensitize it in the bath. Then wash it well, and let it dry. It is then ready to be used in the pressure-frame, like albumenized paper. The printing must be carried considerably farther than on paper. All the other operations of toning and fixing are conducted the same as with paper.

When the opalotype is produced by this method, and the next to be described, a printing frame different from the usual kind, and expressly devised for these pictures, will have to be used, so that the picture may be examined during the course of printing.

Opalotype by Collodio-Chloride.—The ordinary method of producing opal pictures, is by Mr. Wharton Simpson's elegant process, in which the sensitive chloride is held suspended in the collodion. It is scarcely necessary to describe the preparation of the collodio-chloride as it is already an article of commerce, and is sold with full instructions for use.

The plate when coated with this preparation and dried, is ready to be used in the printing-frame, and may be printed, fixed, and toned just as a paper print, except that no more washing will be required than for an ordinary negative.

The use of opal glass as a material to print upon is strongly recommended, especially with Mr. Simpson's process, as greater justice is done to negatives, and pictures of a higher order of beauty are yielded than can be produced on paper.

LONDON: THOMAS PIPER, PRINTER, GOUGH SQUARE, FLEET STREET.